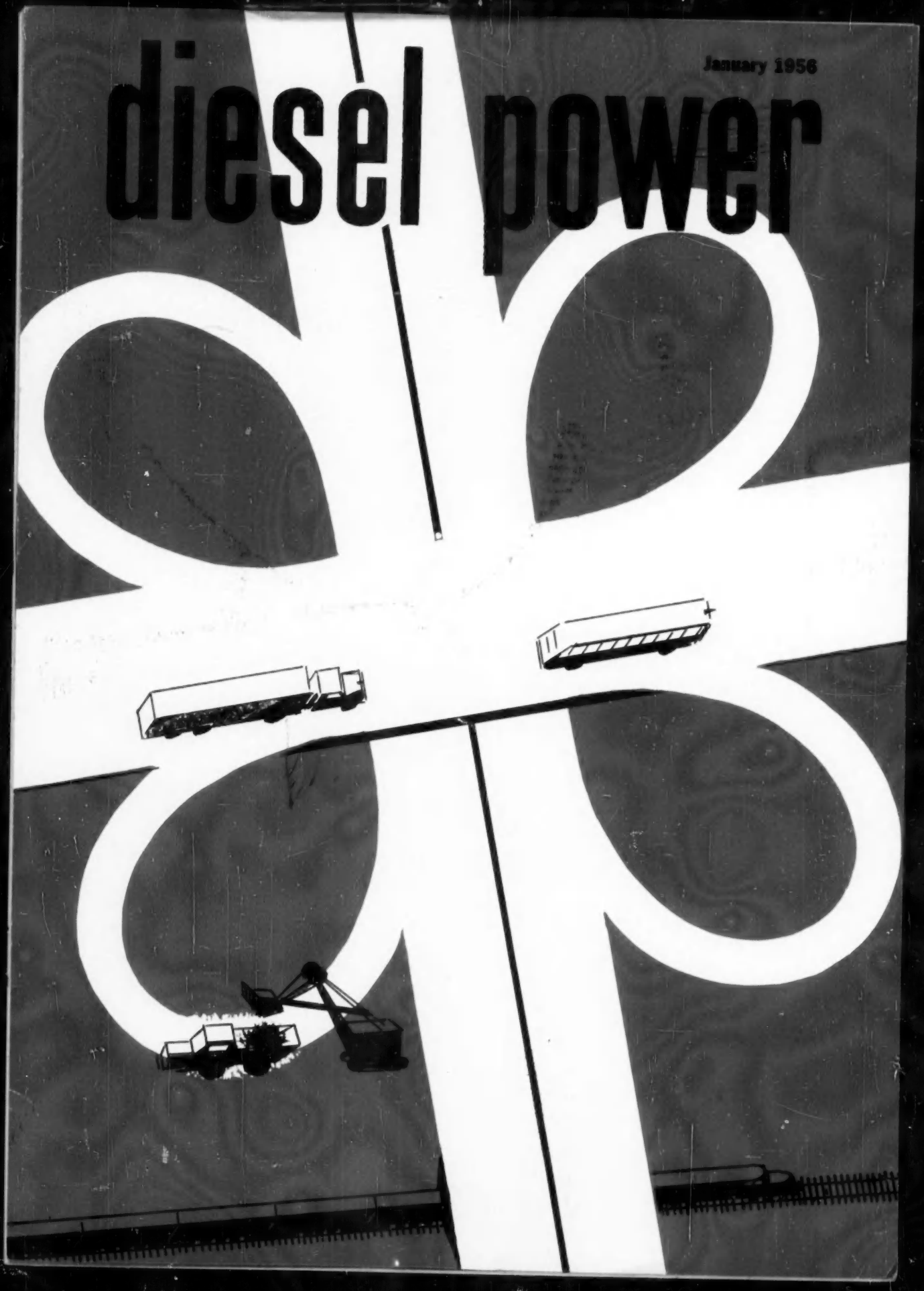
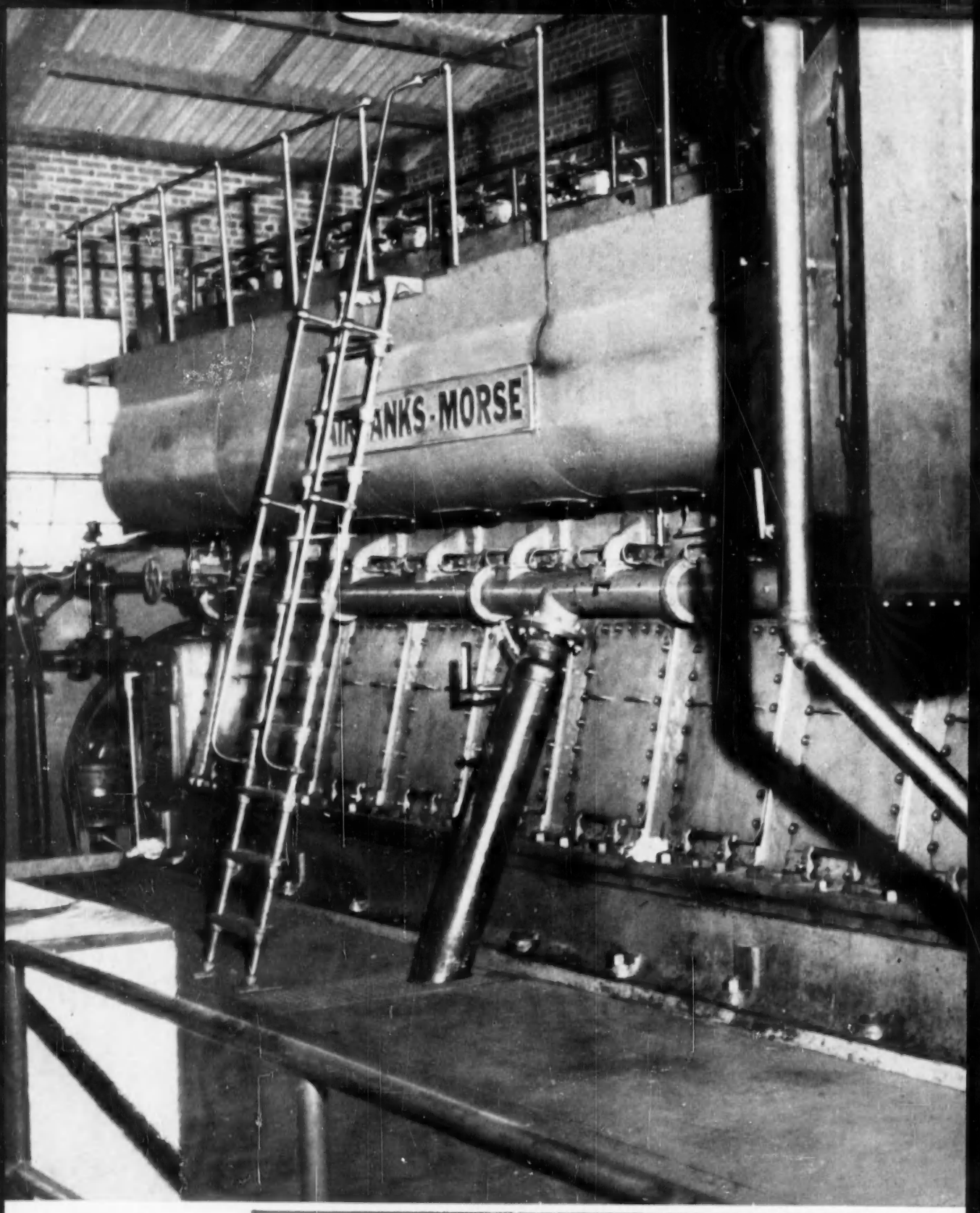
January 1956

diesel power





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radio broadcasts
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WHEN you lubricate with one of the famous *Texaco Ursa Oils*, diesels deliver *more power* with *less fuel* over *longer periods* between overhauls. Performance is clean, dependable—maintenance costs are low.

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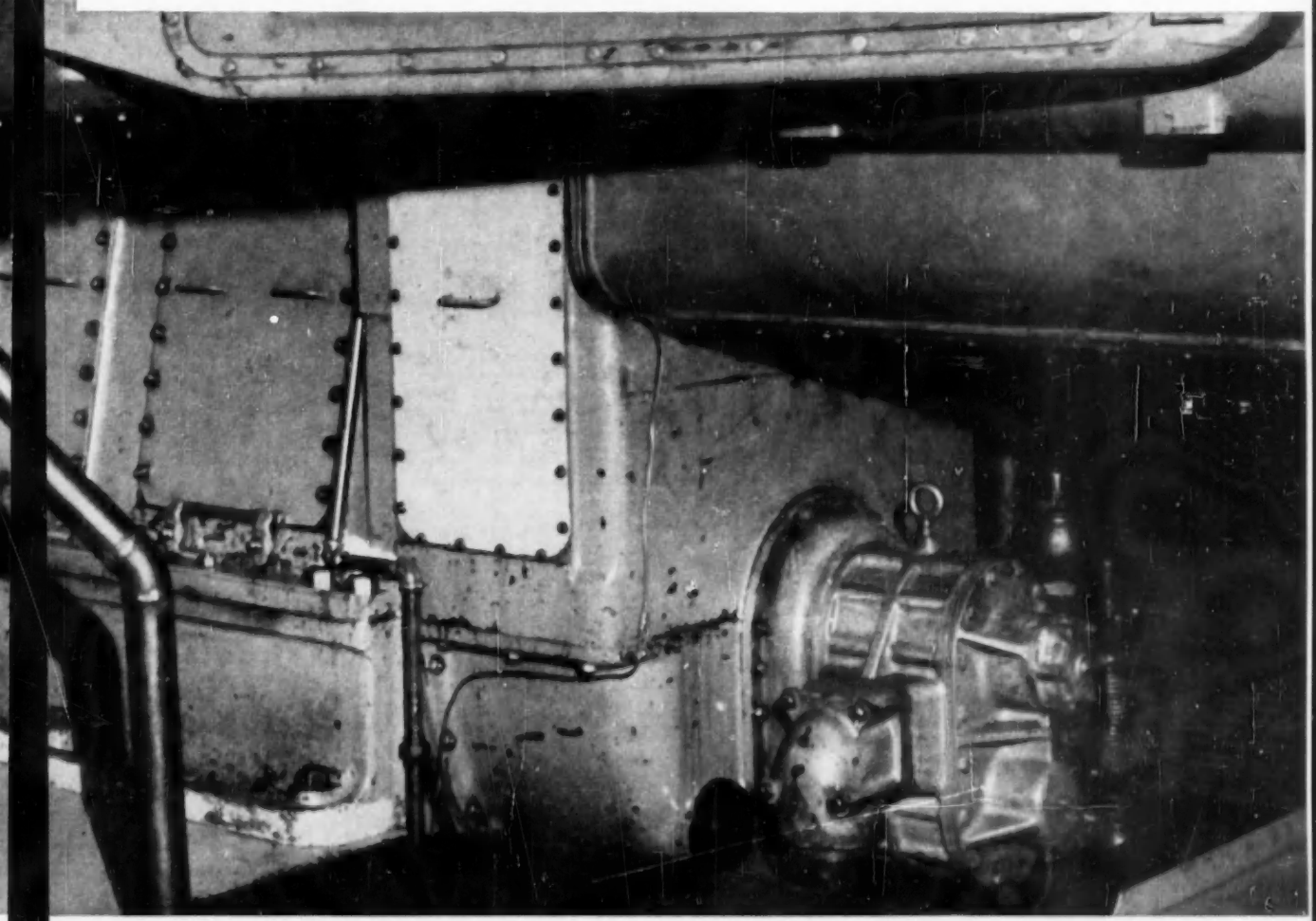
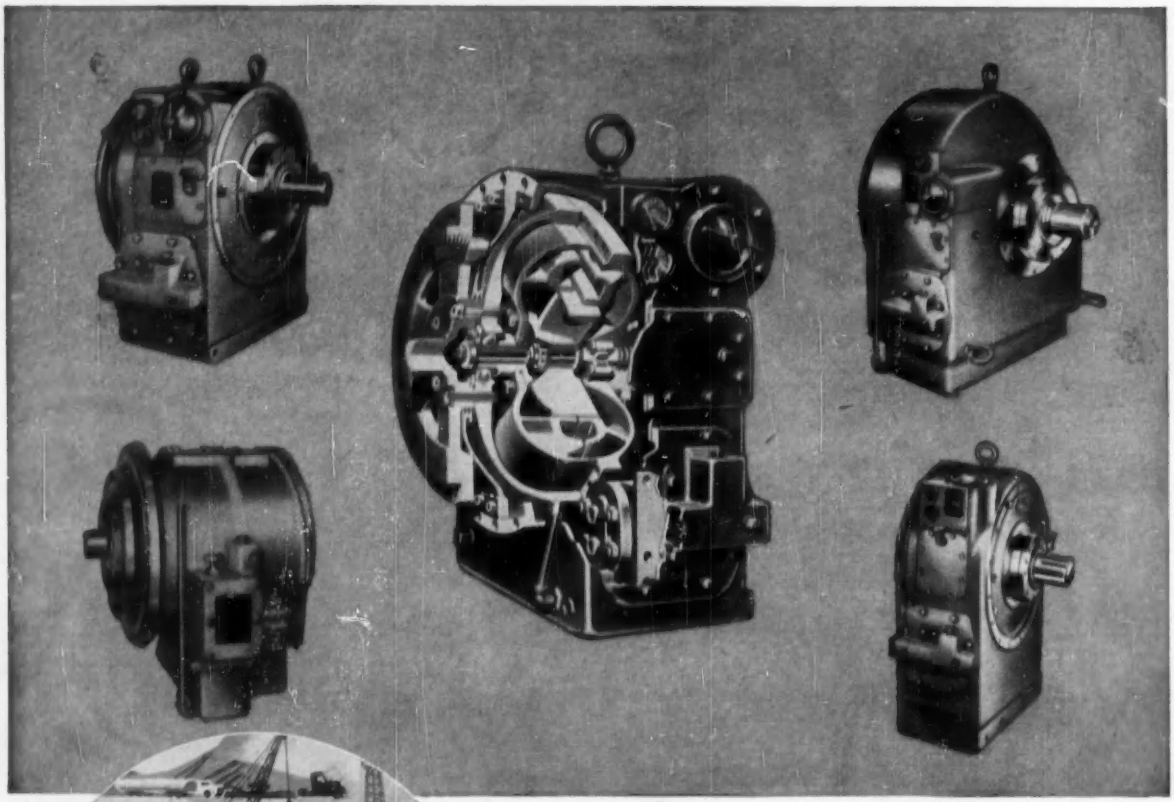
There is a complete line of *Texaco Ursa Oils* especially refined and processed to meet the requirements of all diesel, gas and dual-fuel engines. A Texaco Lubrication Engineer will gladly recommend one to assure you a high-efficiency, low-cost operation.

Just call the nearest of the more than 2,000 Texaco Distributing Plants in the 48 States, or write The Texas Company, 135 East 42nd Street, New York 17, N. Y.



URSA OILS FOR ALL DIESEL, GAS AND DUAL-FUEL ENGINES



For your power need, *whatever it is,* there's a "right" TORCON Model

With a horsepower range from 15 to 600, and fly-wheel diameters from 11 to 26 inches, Torcon has a model that's right for your need — a standard unit available immediately for original equipment or for field installation

Your real benefits begin after Torcon is installed—

- **more work and less wear: Torcon blade design balances engine efficiency and horsepower through the working range—smooth, shockless power that reduces wear, prolongs life**
- **integral unit includes oil pump, sump, pressure regulator; much better efficiency with minimum maintenance**

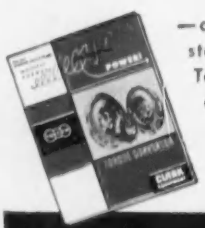
Are you constantly on the look-out for ways to get more efficient power at less cost? Talk to Clark—on all problems of power transmission, from flywheel to point of torque application. You'll find, as do many leading equipment manufacturers, that it's "good business to do business with Clark".

CLARK EQUIPMENT COMPANY, Transmission Division

Falahee Road • Jackson 11, Michigan

Other Products of the Clark Automotive Division . . . TRANSMISSIONS • AXLE HOUSINGS • TRACTOR UNITS • TORCON TORQUE CONVERTERS • ELECTRIC STEEL CASTINGS • GEARS and FORGINGS • FRONT and REAR AXLES for TRUCKS, BUSES and OFF-HIGHWAY EQUIPMENT.

SEND FOR THIS TORCON BULLETIN



—a concise, helpful statement on how Torcon installations cut operating costs, prolong equipment life.

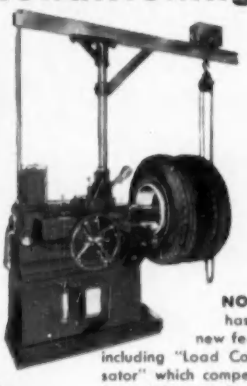
CLARK® EQUIPMENT

There's a *VAN NORMAN* machine

to do the finest reconditioning work on:

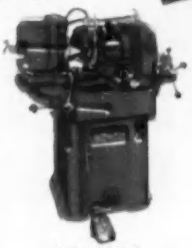
NO. 777-S-4
"Per-Fect-O" Cylinder Boring Bar with vacuum chip-remover. Five other models available.

NO. 101
High Speed Piston Grinder for pistons up to 11" long; 8" diam. Smaller model available (No. 76).

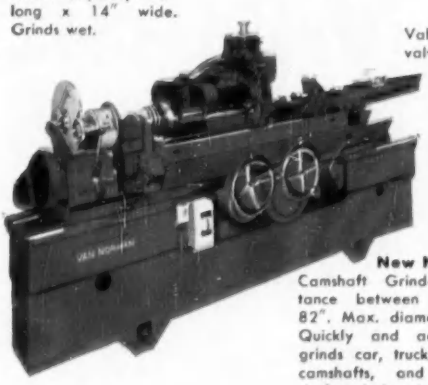


New NO. 404
has many new features, including "Load Compensator" which compensates for weight on main spindle . . . also new wet grinding attachment which permits *dustless* turning and grinding simultaneously. Takes all drum and tire assemblies.

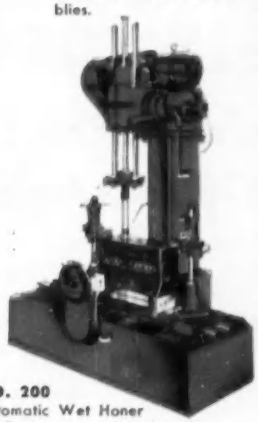
New NO. 562
Head Grinder takes heads, blocks and manifolds. Capacity: 46" long x 14" wide. Grinds wet.



NO. 500-R
Valve Regrinder takes valves from ¼" to 1¼"; all angles from 15° to 75°. One of two models.

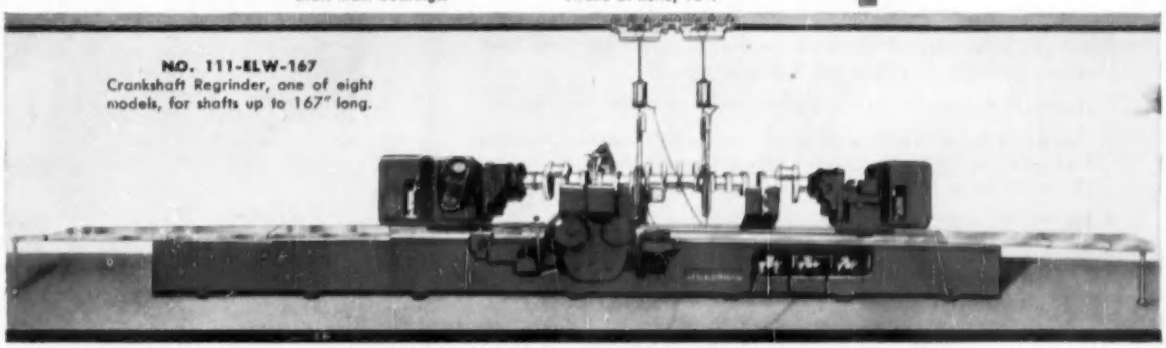


New NO. 253
Camshaft Grinder: Distance between centers, 82". Max. diameter, 9". Quickly and accurately grinds car, truck, tractor camshafts, and crankshaft main bearings.



NO. 200
Automatic Wet Honer duplicates the original cylinder wall finish of the engine manufacturers. Bore diameters 2⅞" to 8". Bore lengths up to 18". Max. stroke of hone, 18".

- Brake Drums
- Clutches
- Cylinders
- Camshafts
- Crankshafts
- Flywheels
- Heads
- Blocks
- Manifolds
- Pistons
- Piston Pins
- Connecting Rods
- Valves



NO. 111-ELW-167
Crankshaft Regrinder, one of eight models, for shafts up to 167" long.

See your Jobber or write

VAN NORMAN AUTOMOTIVE EQUIPMENT COMPANY

Springfield 7, Massachusetts

The Best Equipped Shop is the Van Normanized Shop

MORE POWER FOR DIESELS... with VANASIL PISTONS

"Vanasil Pistons Perfect after 86,226 Miles — Hauling 80 to 100 Ton Payloads"

TRUCK 23—A new set of Vanasil Pistons put in Cummins 300 diesel engine. Power increase permitted using ½ gear higher. Fuel consumption—much better. Oil consumption—good. Motor overhauled after 86,226 miles—"miking" the pistons showed *no wear* and *ring grooves were perfect.*

TRUCK 18 (in photo above)—Has rebuilt Cummins engine from truck 23, with *same Vanasil pistons* and new set of sleeves and rings. Now has several thousand more miles, hauling 80 to 100 ton loads of logs on private roads. This is a Cummins 300 in a Kenworth truck.

OPERATOR'S COMMENTS:

- **Smooth, quiet motor. If you walk away 15 feet, turn your back, you cannot tell if it's a diesel or gas engine running.**
- **Acceleration better for changing gears—more power for steep grades.**
- **Can make better time than other trucks. Truck 23, hauling heaviest load permitted by California laws, regularly saved from ½ hr. to 1 hr. on 115-120 mile run from loading point to Bay area.**
- **Drivers like to drive this "Vanasil" truck.**

(CAREFUL COST RECORDS are kept by this operator of 26 diesel powered trucks which handle 300,000 feet of logs and 60,000 board feet of lumber each working day.)

TRY VANASIL PISTONS!

You'll handle bigger payloads faster. You'll cut down on fuel and oil costs. You'll get long, l-o-n-g, L-O-N-G piston wear and fewer overhauls. Write or phone for circular—let us quote you on Vanasil pistons.

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diesel power

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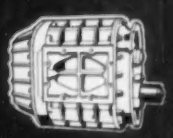

Schwitzer has extensive Research and Engineering facilities and experienced technicians to develop an economical product—for the Flow of Air, Oil, Water and other Fluids—or the Isolation or Elimination of Vibration in your equipment, whether it is in the Automotive, Atomic, Aircraft, Agricultural, Earth Moving, or other fields.

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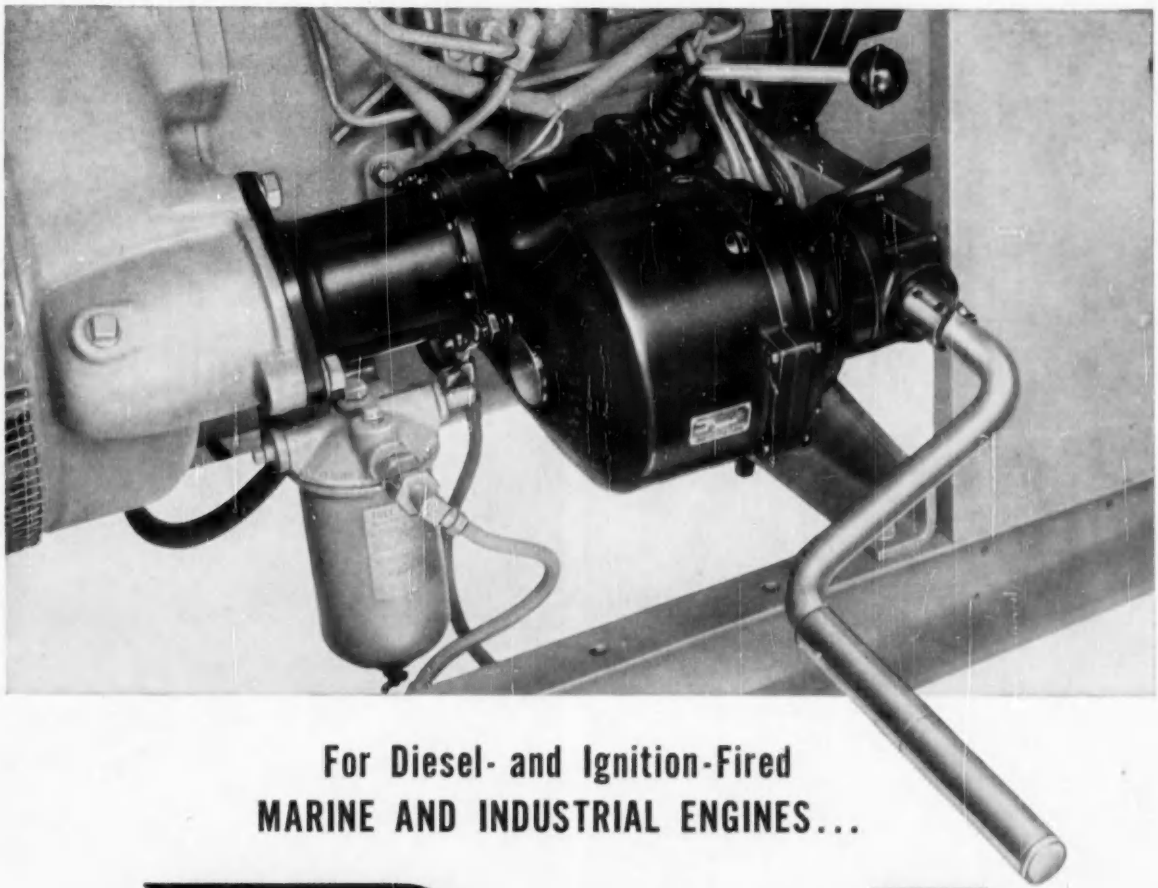


For Diesel- and Ignition-Fired
MARINE AND INDUSTRIAL ENGINES...

Bendix AE

HAND-CRANKED INERTIA STARTER

RUGGED, SIMPLE AND DEPENDABLE—This new hand-cranked inertia starter . . . available in four different models . . . is especially suited for use in remote areas and under difficult operating and climatic conditions.

Use the Bendix AE Inertia Starter where shock conditions can damage storage batteries or disrupt voltage regulation. Use it where battery maintenance is a problem or where there is a fire hazard. Replaces regular electric starter—no alterations to mounting flange needed.

The Bendix AE Inertia Starter is simplicity itself to install—No Cables—No Pump—No Plumbing. Get full particulars today. BENDIX INTERNATIONAL DIVISION, BENDIX AVIATION CORPORATION, 205 E. 42nd Street, New York 17, N. Y., Cable: "Bendixint," N. Y.

IDEAL FOR marine, mining, oilfield, agricultural and construction equipment installations and for standby engines.

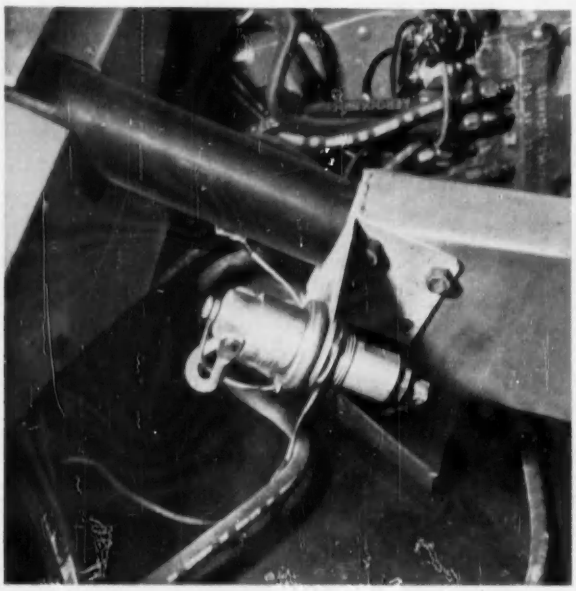
Bendix INTERNATIONAL Product

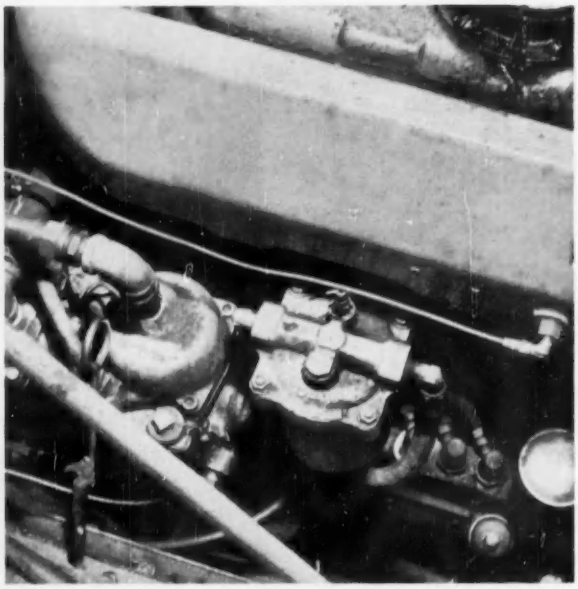
Bendix AVIATION CORPORATION

The Engineer's Field Report

CASE HISTORY
PRODUCT Chevron Pressure Primer System
FIRM Consolidated Freightways Inc., Portland, Oregon

Pressure Primer System starts diesels on 1st or 2nd turn with regular batteries—at minus 40°





BELOW ZERO starting temperatures are common 5 months a year for Consolidated Freightways equipment operating in Mountain and Plain States. Two hundred and forty-four of the company's tractors are equipped with the Chevron Pressure Primer System. Since this installation, rigs start on first or second turn at 40° below zero—using regular equipment batteries! Normally in these sub-zero temperatures, regular batteries give out after about 4 turns. Sure starts plus the fact engines are primed with Chevron Pressure Primer bulbs, controlled from within the cab, saves Consolidated Freightways important man-hours and speeds operating schedules. Picture above (left) shows a Chevron Pressure Primer Discharger mounted on steering column. Highly volatile priming fuel is atomized through tubing into manifold (right) under 250 lbs. pressure.

FREE FOLDER tells you more about Chevron Pressure Primer System and how to install it on different engines. Write or ask for it today.

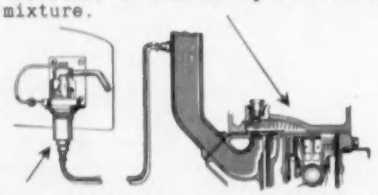
FOR MORE INFORMATION about this or other petroleum products of any kind, or the name of your nearest distributor, write or call any of the companies listed below.

CHEVRON

TRADEMARK "CHEVRON" REG. U. S. PAT. OFF.

Why Chevron Pressure Primer System helps starting

Volatile Chevron Priming Fuel atomizes in induction system at temperatures as low as -65°F. Pressure or weakest spark from engine fires mixture.

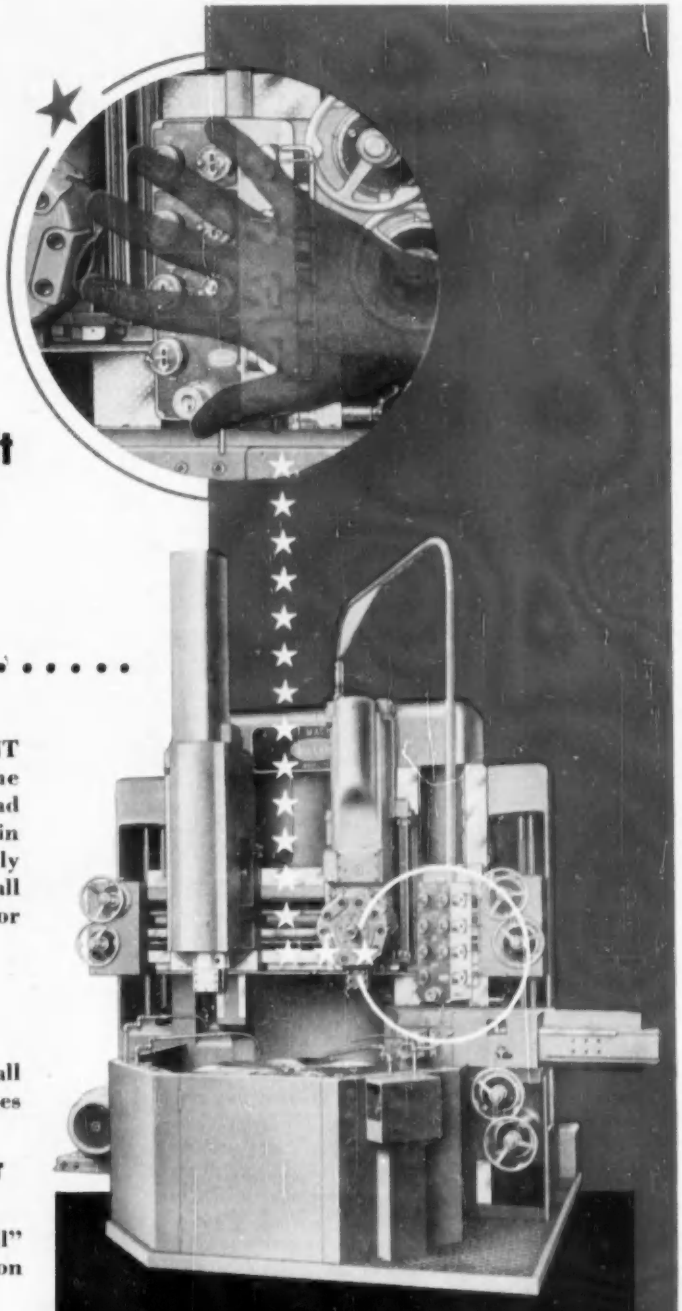


Simple, rugged discharger prevents fuel leakage. Small, safe steel bulbs protect fuel from water and dirt.

STANDARD OIL COMPANY OF CALIFORNIA, San Francisco 20 • STANDARD OIL COMPANY OF TEXAS, El Paso
THE CALIFORNIA OIL COMPANY, Perth Amboy, New Jersey • THE CALIFORNIA COMPANY, Denver 1, Colorado

Within the Span of a Man's Hand

The power to transmit the commands of the operator *to the machine* . . . . . .



By means of the movable PENDANT CONTROL the start and stop of the spindle; selection of speeds, feeds and directional movements of all heads in feed or traverse are quickly and easily accomplished. Interlocks and a stopall stick provide safety for both operator and machine.

Additional features include:

SCREW FEED

for vertical and horizontal motion of all heads — to assure fine smooth finishes with greater accuracy.

POWER INDEXED MAIN TURRET (optional)

Five sided turret for "run of the mill" jobs. Four sided turret for production jobs.

SEVENTY FIFTH BULLARD ANNIVERSARY

CUTMASTER VERTICAL TURRET LATHE Model 75

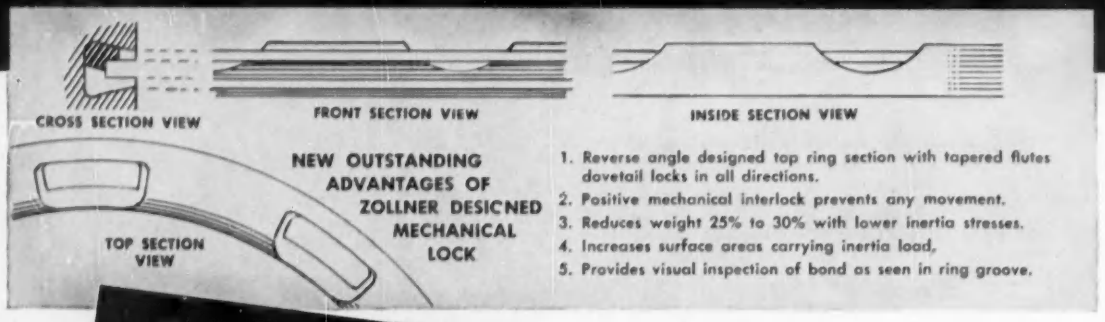
THE BULLARD COMPANY

BRIDGEPORT 2, CONN.

AVAILABLE IN 26, 36, 46, 56, 66 AND 76 INCH SIZES

BOND-O-LOC* PISTONS

WITH "NI-RESIST" IRON TOP RING SECTION


CROSS SECTION VIEW
FRONT SECTION VIEW
INSIDE SECTION VIEW
TOP SECTION VIEW
NEW OUTSTANDING ADVANTAGES OF ZOLLNER DESIGNED MECHANICAL LOCK
1. Reverse angle designed top ring section with tapered flutes dovetail locks in all directions.
2. Positive mechanical interlock prevents any movement.
3. Reduces weight 25% to 30% with lower inertia stresses.
4. Increases surface areas carrying inertia load.
5. Provides visual inspection of bond as seen in ring groove.

Double Bonded

METALLURGICALLY Al-Fin Bond

MECHANICALLY Zollner Lock

STOPS!

RING GROOVE WEAR IN HEAVY DUTY SERVICE

"Sensational mileage" is the unanimous report of heavy duty engine builders and transport operators using Zollner "Bond-O-Loc" Pistons. Another great development by Zollner engineers, this super-mileage piston has a "Ni-resist" top ring groove section *permanently* incorporated with the *double* bond of *both* Al-Fin metallurgic *and* the exclusive Zollner mechanical lock. Separation failure is impossible. Ring groove wear problems are eliminated, blow-by prevented, oil consumption minimized, mileage to overhauls greatly increased. We suggest an immediate test of these sensational advantages for your engine.

Licensed under Patents 2,396,730; 2,455,457; 2,550,879

*T. M. Reg. Pat. App. For

ADVANCED ENGINEERING

PRECISION PRODUCTION

COOPERATION with Engine Builders

ZOLLNER PISTONS

THE ORIGINAL EQUIPMENT PISTONS

ZOLLNER

ZOLLNER • Fort Wayne, Indiana

COOL SWEEP!

HARRISON COOLERS SPECIFIED FOR NAVY MINE SWEEPER!

From stem to stern . . . Harrison holds the heat! Twenty-three Harrison coolers are at work on this Navy mine sweeper. These heat exchangers are rugged, reliable . . . designed to save space, weight and money, too! That's why Harrison gets the call for cooling . . . on land, in the air . . . or at sea! And Harrison's engineering and research departments never stop searching for new ways to do the cooling job faster, more efficiently, more economically.

If you have a cooling problem, look to Harrison for the answer.

HARRISON RADIATOR DIVISION, GENERAL MOTORS CORP., LOCKPORT, N.Y.

HARRISON

TEMPERATURES MADE TO ORDER

Random Thoughts from a Filter Engineer

by Henry Matlock

- **WHEN IT'S FUN TO BE WRONG**
- **WHY THREE SELF-CLEANING FILTERS INSTEAD OF ONE**
- **A DRY TYPE FILTER THAT TENDS TO CLEAN ITSELF**

WHEN IT'S FUN TO BE WRONG

When a filter doesn't behave the way a manufacturer says it will, he has some explaining to do. Recently, we found ourselves in this position. Our liquid filters are performing more efficiently than we claim. And our customers have the facts and figures to prove it.

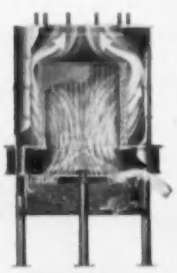
For instance, we claimed one filter would stop all particles larger than 46 microns but independent laboratory tests proved it stopped 99.2% of all particles larger than *20* microns! We claimed another filter would stop all particles larger than 81 microns. One customer made a series of tests and found 93% of the particles collected were smaller than 20 microns! Why the discrepancy? Didn't we know how good our own filters were?

We've known for a long time that our filters perform more efficiently than we guarantee. Here's why. If the openings in a filter will admit particles of 50 microns in size but no larger, that's the rating we give the filter. But, in actual practice, many particles of much smaller size are stopped. That's because liquid filters very quickly build up a "filter aids bed". Dirt particles wedge themselves in the 50 micron openings, actually reduce the size of the openings and prevent particles bigger than, say, 20 microns from passing through. This partially explains the exceptional results our customers report. And it's another reason why so many engine builders and contractors are adopting Air-Maze liquid filters as standard equipment.

WHY THREE SELF-CLEANING FILTERS INSTEAD OF ONE

The more suited a filter is to a problem, the better job it will do. That's why we at Air-Maze offer three different self-cleaning diesel air filters. The question is often asked, why three types? Well, in the diesel engineering field air filters have to satisfy many different pressure drop requirements.

Regular Oil Bath



Low Pressure Drop Oil Bath

Automaze

Where pressure loss is extremely critical, choose the Automaze, which incidentally can be furnished in muliple units to handle air flows up to 100,000 CFM or more. Our Automaze utilizes the pulse action cleaning provided by outside air pressure. For minimum pressure loss without any outside energy being required, the LPD (Lowest Pressure Drop) filter is the ticket. It's available in single units up to 20,000 CFM. And where pressure drop is not a critical factor, our standard type F oil bath filter can be used in single units up to 6500 CFM.

Of course you can see there may be some overlapping of these units, but they do illustrate the point that Air-Maze offers air filtration for diesel engines, compressors or blowers to meet almost every requirement. We even have a panel type air filter available in a self-enclosed housing. This one, type DH, requires manual servicing.

A DRY TYPE FILTER THAT TENDS TO CLEAN ITSELF

Dry Filter

If you need a particularly efficient dry type filter, our DA filter may be the best solution to your problem. Its felt media will stop dirt particles down to $\frac{2}{10}$ of a micron. And it's especially suited to applications where vibration is present. A good deal of the dirt that accumulates on this filter will be harmlessly shaken off. So, in a way, our DA filter is self-cleaning. Life of the element can be considerably prolonged by removing dirt with suction or a solvent such as mineral spirits, or by blowing it off.

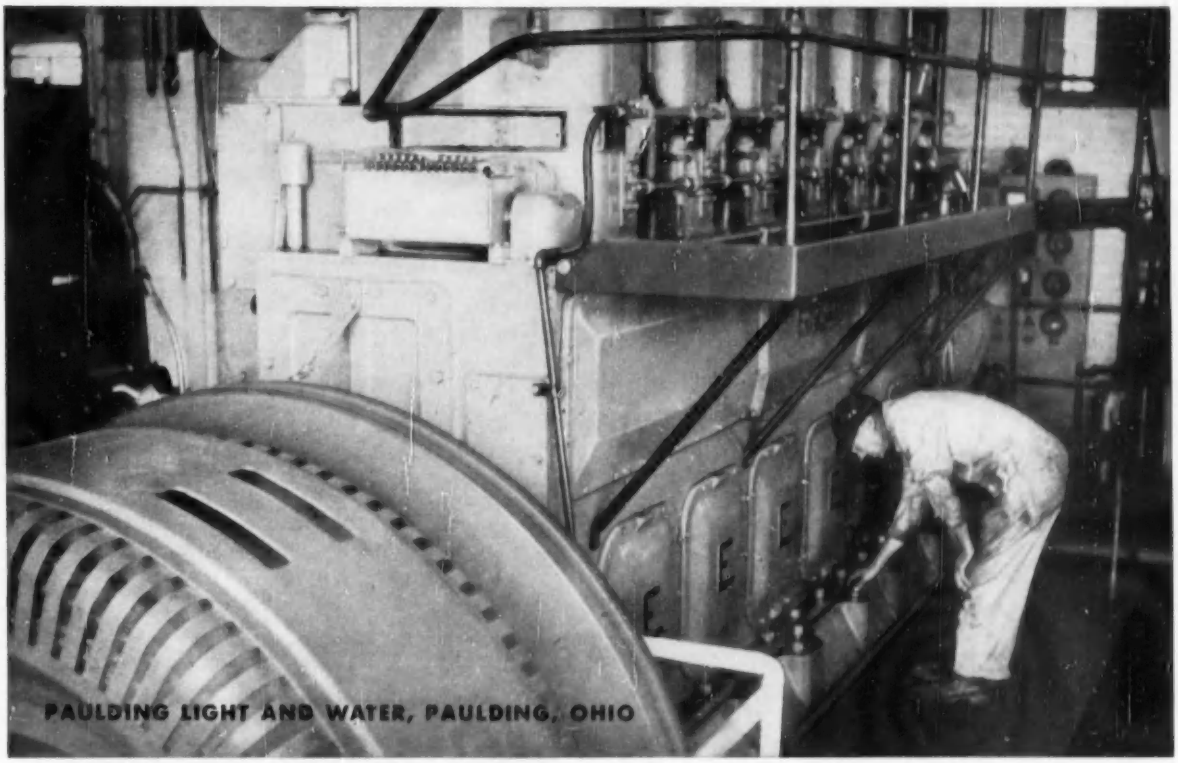
For high efficiency and low maintenance, our DA dry type filter is hard to beat. The Air-Maze Corporation, 25000 Miles Road, Cleveland 28, Ohio.

AFI MEMBER

AIR-MAZE

The Filter Engineers

AIR FILTERS • SILENCERS • SPARK ARRESTERS
LIQUID FILTERS • OIL SEPARATORS • GREASE FILTERS



"16,587,402 H. P. hours without oil change using Cities Service C-300 Lube Oil!"

1000 KW Enterprise uses only one gallon of oil in 23,205 BHP hours, has no oil reclaimer.

The main part of the power output of Paulding Light and Water Company is developed by its dual-fuel, 1000 KW Enterprise Unit.

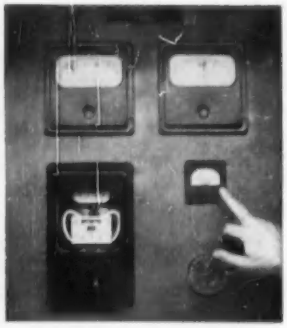
Mediocre performance can't be tolerated at Paulding . . . the power load is running twice that of seven years ago!

"Fortunately," says Superintendent James J. Leslie, "performance is tops—and much of the credit is due Cities Service C-300 Lube Oil. We really pile up hours with C-300 . . . and still get excellent engine life. I've never had the head off the Enterprise since it was first installed in 1953, yet compression, fire pressure, and fuel economy are still very good.

"We've actually logged up to 16,587,402 H.P. hours without an oil change. We use only 1.5 gallons of C-300 Lube Oil per day, which amounts to 23,205 brake-horsepower hours per gallon . . . and that's with no oil reclaimer! I'd recommend Cities Service to any power plant."

If you're interested in Mr. Leslie's recommendation, talk with your Cities Service Lubrication Engineer. He can tell you of other outstanding case histories. Or write: Cities Service Oil Co., Sixty Wall Tower, New York 5, N. Y.

Electric Service Goes Hand in Hand with Cities Service at Paulding Light & Water. Paulding's Enterprise dual-fuel power unit gets 23,205 BHP hrs. for every gallon of Cities Service C-300 Oil that's consumed. Oil changes are made about every 11,000 hrs.



"We're Really Able to Pile Up Hours and still get good engine life using Cities Service C-300 Lube Oil," says Supt. Leslie. "I've never had the head off the Enterprise since it was installed in 1953. Compression, fire pressure, and fuel economy are excellent."

CITIES SERVICE

QUALITY PETROLEUM PRODUCTS

GM DIESEL
CASE HISTORY NO. II AG-1:

• • • • • •

USER: Lowery Bros. Lumber Co., Spurger, Texas

• • • • • •

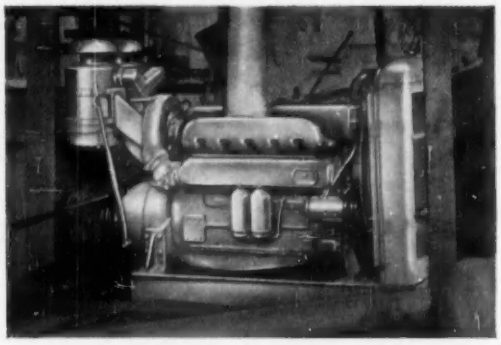
INSTALLATION: GM "6-110" Diesel engine powering Cunningham mill, saw, edger and conveyors.

• • • • • •

PERFORMANCE: Producing 25,000 bd. ft. of 1" lumber per day. Co-owner Lester Lowery says, "GM Diesel power actually 'put us in business'—downtime is a thing of the past—we cut faster, cleaner and save money, too."

PRODUCTION TRIPLED

since they switched to
General Motors Diesel



THIS Texas mill was turning out 8,000 bd. ft. of lumber per day with a gasoline engine. The owners put a GM "6-71" to work replacing the gasoline engine in 1952, and boosted production to approximately 16,000 bd. ft. per day. Then, wanting still more power, they switched the "6-71" engine to a portable mill (designed by Lester Lowery) in 1953 and installed a GM "6-110" engine. Production then went to 25,000 bd. ft. per day.

"Higher production at lower cost!" That's the report you'll hear from thousands of operators who use General Motors Diesel power—particularly owners who have stepped up their power with the new "110" engine in sawmills and other equipment. This 300-H.P. GM Diesel operates on the same 2-cycle principle as the famous "71." With every downstroke of every piston a power stroke, it delivers a smooth, steady flow of power that's quick to respond to varying loads—cuts faster, cleaner and more economically.

Operators tell us their GM Diesels run for years without overhaul, but when parts or service are needed they're quickly available at low cost. For full details on GM Diesel power in new equipment—or in your present units—call in your GM Diesel distributor or write:

DETROIT DIESEL ENGINE DIVISION
General Motors • Detroit 28, Michigan
America's Largest Builder of Diesel Engines
Single Engines . . . 30 to 300 H. P. Multiple Units . . . Up to 893 H. P.

GM
GENERAL MOTORS
DIESEL POWER

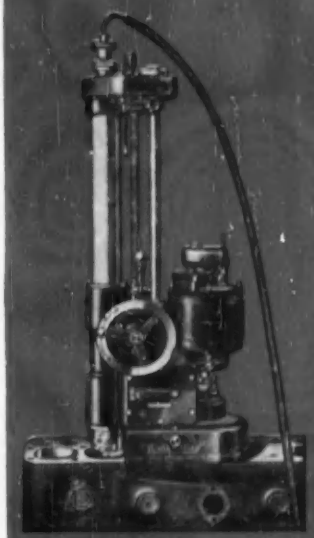
MORE SPEED • GREATER ACCURACY

with Kwik-Way CYLINDER BORING MACHINES on the job

KWIK-WAY Cylinder Boring Machines are simple in set up and operation. They're precision engineered for maximum accuracy—real time-savers on all types of boring jobs.

Call in your KWIK-WAY man for a demonstration . . .
See these superior features in action:

- **Overhead chip removal**
- **Screw feed with automatic retraction**
- **Two speeds—instantly changeable**
- **Three finger centering**
- **Quick, positive, non-distorting anchoring**
- **Rigid construction—no additional supporting devices necessary**
- **Bores close to dash**
- **V-belt spindle drive eliminates evidence of gear chatter on finished cylinder wall**
- **Pre-loaded spindle bearings**
- **Quick, easy, accurate tool setting eliminates "sense-of-feel"**



Model "FT"
Capacity
2.630" to 5 9/32",
12½" stroke

Model "FR"
Capacity
2.2" to 4 7/16",
12½" stroke

KWIK-WAY precision equipment is sold only through factory trained representatives. Mail the coupon below for appointment or complete information.

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SERVING THE MOTOR REBUILDING INDUSTRY SINCE 1920

VALVE FACING MACHINES • VALVE SEAT GRINDERS • VALVE SEAT INSERT TOOLS CYLINDER BORING MACHINES • VORTEX SUCTION DEVICE • LINE BORING MACHINES • PISTON CAM TURNING AND GRINDING MACHINES.

Cedar Rapids Engineering Co.,
918 17th Street N.E., Cedar Rapids, Iowa

☐ Please send complete details on Kwik-Way Cylinder Boring Machines
☐ Kwik-Way Man to Call
☐ _____
Other Equipment in which interested

Name _____
Company _____
Street _____
City _____ State _____

WHEN YOU DEMAND CRITICAL PRECISION

Only one part . . . the spool . . . moves in this ingenious MAC 4-way air valve. It's an oscillation that must be critically precise . . . and is. The C/R Sirvene (synthetic rubber) parts seal the valve circuits under pressures up to 150 psi and over a wide range of temperatures and cycle speeds. To operate correctly, those small Sirvene parts must be molded to unusually close dimensional tolerances. C/R is consistently meeting . . . and beating these tolerances. And MAC reports that on the toughest jobs their valves have run for millions of cycles without trouble.

You can have the same dependability. Whenever your mechanism design demands the most exacting qualities in a molded pliable part . . . depend on Sirvene. As a start—write for your copy of the new "Sirvene" booklet.

SIRVENE C/R DIVISION

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CHICAGO RAWHIDE MANUFACTURING COMPANY

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In Canada: Manufactured and Distributed by Super Oil Seal Mfg. Co., Ltd., Hamilton, Ontario

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Other C/R Products

C/R Shaft and End Face Seals • Sirvis-Conpor mechanical leather cups, packings, boots • C/R Non-metallic Gears

cut your diesel maintenance costs with

PUROLATOR

in these three spots

Even the cleanest fuel supply brings damaging dust, dirt and grit into your diesel engine. Without filtration, injection pumps gall, wear and lose their accuracy. Nozzles get plugged and burn. Even if your engine goes on running, the power output of individual cylinders goes badly out of balance.

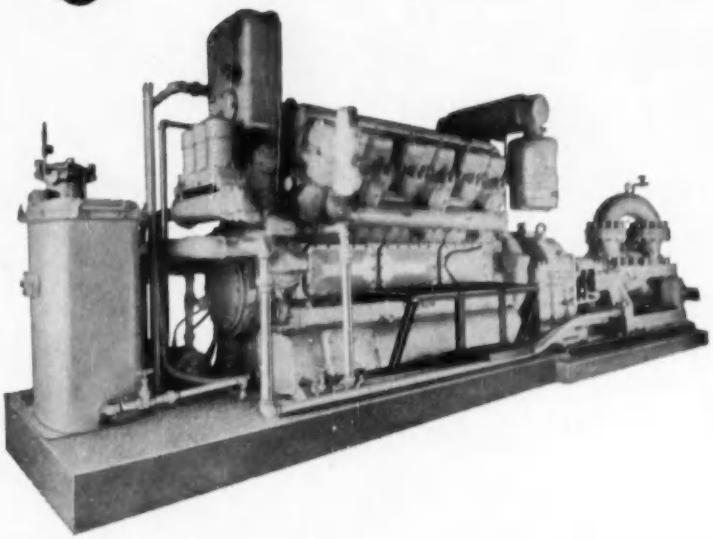
So . . . effective fuel oil filtration is absolutely essential. For your engine to keep running at peak efficiency and with minimum outlay for maintenance, its fuel system should be equipped with PUROLATORS in the three areas listed at the right.

For details of the PUROLATOR models designed for use in these diesel applications, write today for the PUROLATOR diesel catalog. Address Purolator Products, Inc., Rahway, N. J., Dept. DP1-111

Immediately before and after the transfer pump. The PUROLATOR on the suction side protects the pump. The one on the pressure side takes out any bits of metal worn from the moving pump parts.

In the fuel line before the injection pump. A PUROLATOR here is an inexpensive way to assure smooth, wear-free operation of the injection pump.

Built into each injection nozzle. While there is no obvious source of contamination beyond the injection pump, experience shows that an individual metal-edge filter element built into each nozzle assembly vastly improves nozzle life expectancy.



PUROLATOR

"FIRST IN THE FIELD OF FILTERING"

PUROLATOR PRODUCTS, INC., Rahway, New Jersey

Instant shifts on the go

BIG NEW ADVANCE in shovel-type loaders is the Hough Model HO 4-wheel-drive PAYLOADER.

And one of the biggest features of this 2-yard workhorse is its great new TORQMATIC DRIVE designed by Allison expressly for shovel-type loaders.

Hough calls this integrated TORQMATIC Converter-Transmission team the "easiest-operating, fastest-acting, most efficient power-shift transmission ever put into a tractor shovel."

And they also say that the TORQMATIC DRIVE *permits "instant shifting from any speed range to any other on the go —no stopping, no foot clutching."*

That means faster job cycles, easier loader operations, more yardage moved per shift.

The HO PAYLOADER is available with either gasoline or Diesel power. The engines will last longer, operate more efficiently driving through a TORQMATIC Converter because it instantly matches engine speed and torque to the load—multiplies engine torque up to 350% to broaden the *working* horsepower range.

Today Allison's new TORQMATIC DRIVE is available in many models of shovel-type loaders—will soon be offered in a wide range of other equipment made by leading manufacturers.

If you'd build or buy a better product, get full information on this great new TORQMATIC DRIVE by writing to Allison Division of General Motors, Box 894S, Indianapolis 6, Indiana.

ADC* REPORT

LOUISVILLE TRANSIT COMPANY, LOUISVILLE, KENTUCKY

adopts Shell ADC Oilprint Analysis as major oil change yardstick . . .

uses it for faster, surer Preventive Maintenance

LOUISVILLE TRANSIT COMPANY, noted for its preventive maintenance record, has adopted the ADC Oilprint Analysis. Result: reduced PM time and outstanding economy in labor and parts.

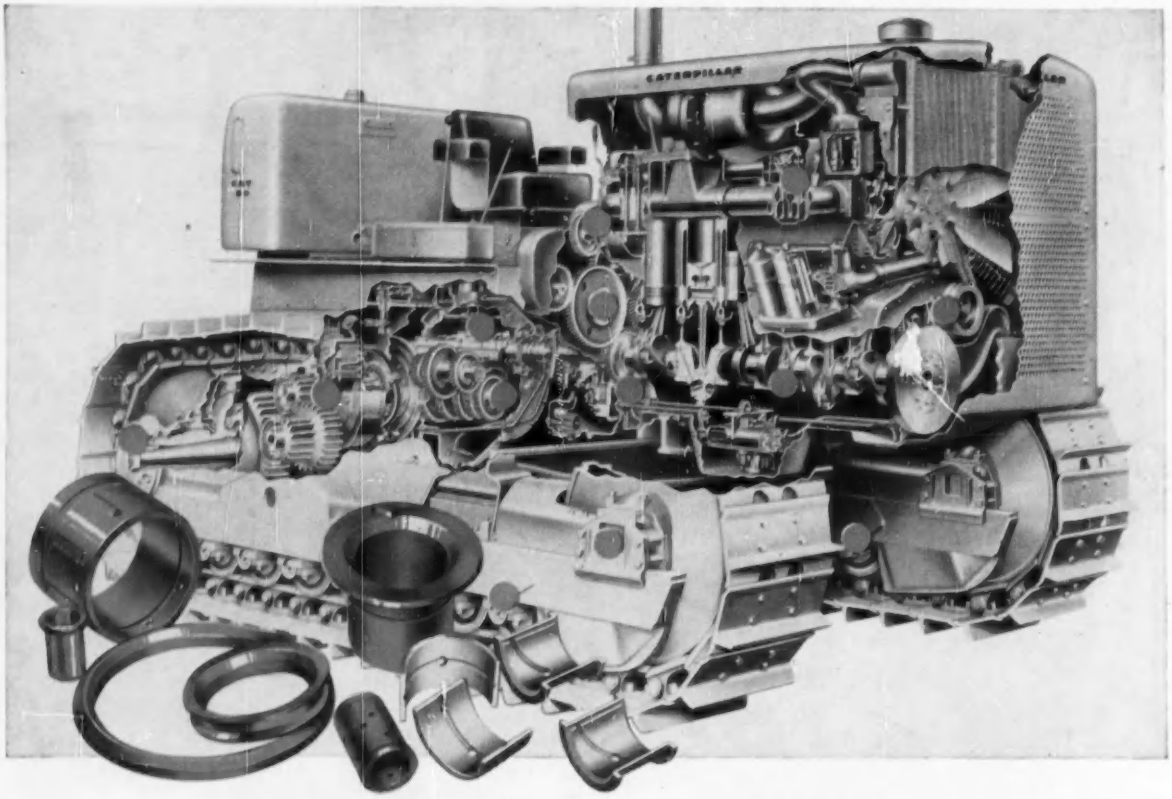
The ADC Oilprint Analysis enables fleet operators to test the condition of crankcase oil in the short time allotted for re-fueling and crankcase oil checks . . . a dependable evaluation in *minutes*. It answers the question "When do I change my oil?", thus eliminating the draining of usable oil and the risk of using oils loaded with contaminants.

ADC Oilprint Analysis can take an active part in your PM program. Let us demonstrate how it can effect savings for your engines. *Trademark

SHELL OIL COMPANY

50 WEST 50th STREET, NEW YORK 20, NEW YORK
100 BUSH STREET, SAN FRANCISCO 6, CALIFORNIA

SHELL



Dependable Johnson Bearings

Help Give Long Life To Big Cat Machinery

Engine bearings and bearings in track rollers and other components play a big role in the ability of Caterpillar Diesel Tractors to give long, satisfactory performance on tough jobs.

Caterpillar Tractor Co., manufacturers of the big yellow, earth moving rigs you see at every hand, makes certain that each part has the quality and stamina to give trouble-free service.

The ability of Cat equipment to handle difficult assignments depends in part on bearings obtained from Johnson Bronze Company of New Castle, Pa., which supplies a wide variety of the bearings used throughout Caterpillar products.

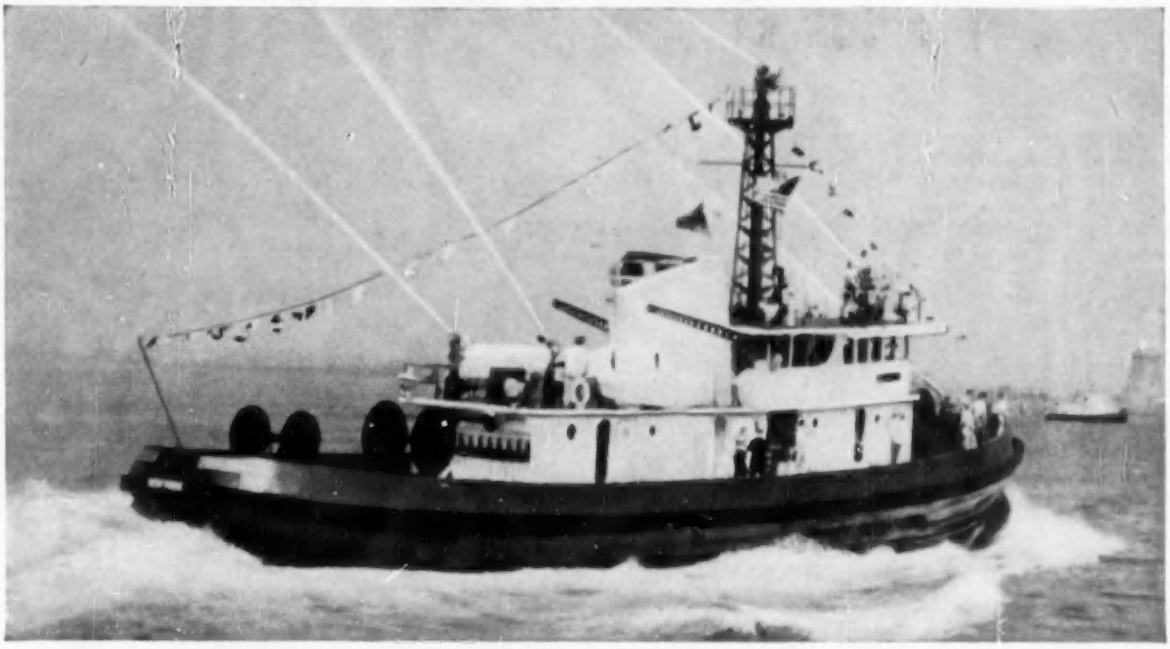
Dependable Johnson bearings—made of aluminum on steel, babbitt on steel, cast bronze, bronze on steel, and sintered bronze powder (Ledaloyl)—help Caterpillar meet its triple objective of: 1. durability, 2. bigger pay loads, and 3. longer life. Johnson also offers Caterpillar sound engineering help, has a complete line, maintains uniform high quality and consistently meets Caterpillar's specifications.

This is a typical example of the service Johnson gives many manufacturers in all industry by supplying them with many types of bearings for a wide variety of applications—from automobiles to sound recorders—from automatic washers to machine tools—to name but a few.

To enjoy the dependability and economy of Johnson bearings in your products, write for information on how Johnson engineers will work with you to make a better product at lower cost. Johnson Bronze Company, 470 S. Mill Street, New Castle, Pennsylvania.

Johnson Bearings

LEDALOYL (powder metallurgy) • ALUMINUM ON STEEL • BRONZE ON STEEL • STEEL AND BABBITT • CAST BRONZE



New York City fireboat pumps 14,000 gallons per minute without warmup . . . thanks to ENTERPRISE DIESELS and Bendix FUEL INJECTION EQUIPMENT!

As an emergency vessel the *John D. McKean*, New York City's newest fireboat, must be ready to go into action at a moment's notice. This means that her main propulsion and pumping engines, 4 Bendix-equipped Enterprise Diesels, may be called upon at any time to drive her full speed ahead while spraying up to 14,000 gallons of water per minute!

Obviously this is a job where constant dependability is the foremost requirement. In fact, it would be difficult to subject these Bendix-equipped Enterprise Diesels to a more rigorous task. Yet, the *John D. McKean* in a highly successful series of dock and sea trials met every rugged requirement for which she was designed.

Here, once again, is further proof that for reliable performance, Bendix* Fuel Injection Equipment is the logical choice for any diesel engine manufacturer.

*REG. U.S. PAT. OFF.

SCINTILLA DIVISION OF BENDIX AVIATION CORPORATION
SIDNEY, NEW YORK

Export Sales: Bendix International Division • 205 East 42nd Street, New York 17, N.Y.

SCINTILLA DIVISION

Bendix
AVIATION CORPORATION

WORLD'S LARGEST . . .
and a perfect TARGET for DUST!

Twelve Type W Cycoils clean scavenging air for six 1600-hp. diesels (shown in inset) at Station 5-A—world's largest low-lift pump plant located midway between Lake Okeechobee and West Palm Beach, Fla.

New Florida Pumping Station "Plays it Safe" by Installing Cycoil Oil Bath Air Filters

Everything about Station 5-A is "big". Its six pumps have a daily capacity of over 3 billion gallons—that's three times the daily water consumption of New York City. Powering these pumps are six 1600-hp. Fairbanks-Morse Diesels. Their combined job—to protect Florida against rampaging floods and devastating droughts through year 'round control of Lake Okeechobee.

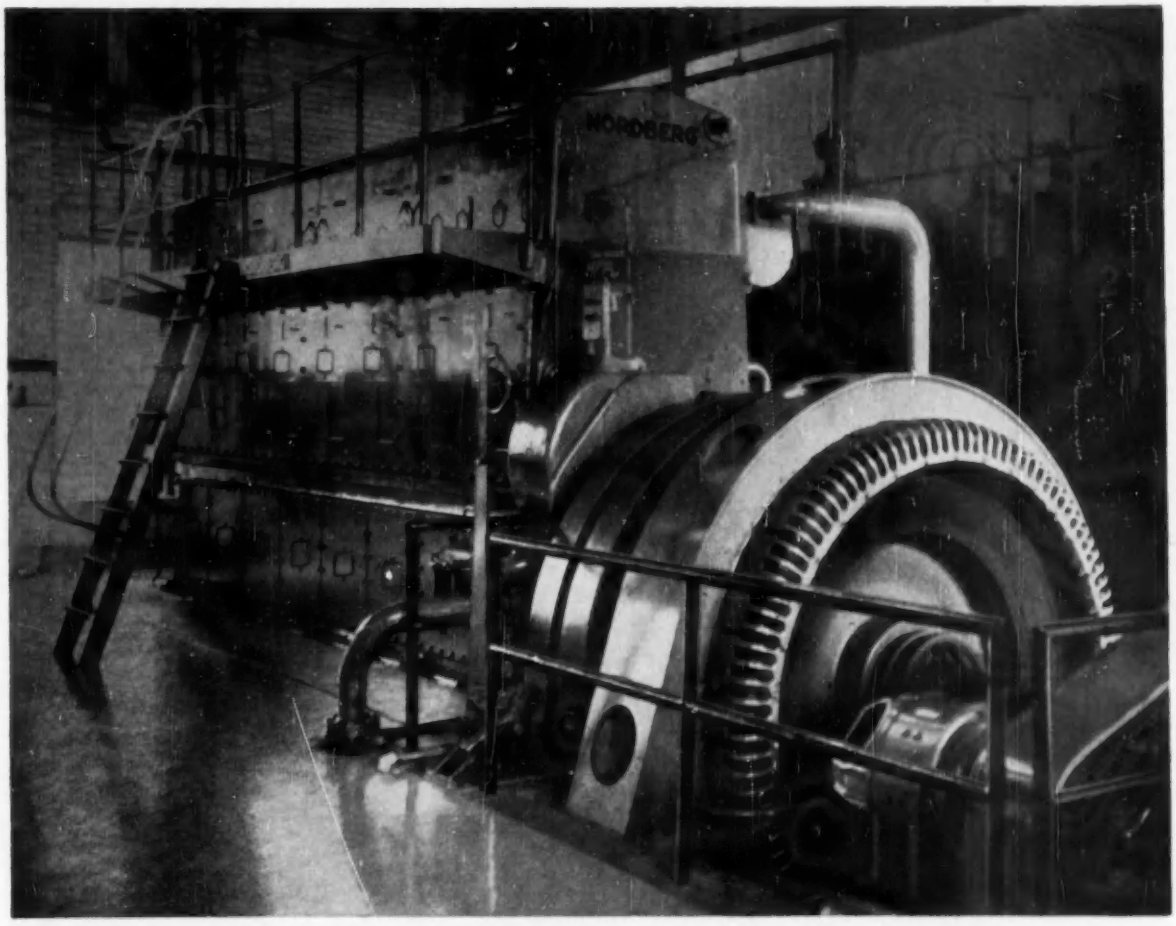
Recognizing the importance of this operation, action was taken to insure that dust will never become "a monkey wrench in the machinery". Two Type W Cycoils placed at air intake of each of the six Diesels guarantee freedom from dust damage. Two-way cleaning action of these oil bath filters leaves nothing to chance. Thorough mixing of oil with intake air traps 90% of the dust content. The remaining 10% falls easy prey to Cycoil's filter pads.

Cycoil's complete protection costs but a fraction of a major shutdown to repair the damages of dust. For complete product information, write for Cycoil Bulletin 130.

AAF herman nelson

American Air Filter
COMPANY, INC.

American Air Filter of Canada, Ltd., Montreal, P. Q. • 445 Central Avenue, Louisville 8, Kentucky



After 30,000 hours Koppers Piston Rings still maintain "excellent" compression

At the Neodesha Municipal Power Plant, Neodesha, Kansas, Koppers Piston Rings are an important part of the 1750 bhp. Nordberg Duafuel Engine illustrated above. After 30,000 hours of operation the pistons on this engine have never been pulled, and compression is still excellent. It is interesting to note that this Nordberg Engine, equipped with Koppers Piston Rings, has been in operation over 98% of the time—and carries about 90% of the plant load.

Koppers has widely experienced engineers and extensive manufacturing facilities which combined can fill the most difficult of piston ring requirements. Next time you are concerned with piston rings or sealing rings, whether in replacement or new installations—in engines large or small—call on Koppers. Never any obligation, of course. For more information, mail coupon.

KOPPERS

METAL PRODUCTS DIVISION • KOPPERS COMPANY, INC. • Baltimore, Maryland
This Koppers Division also supplies industry with Fast's Couplings, Aeromaster Fans, Koppers Electrostatic Precipitators and Gas Apparatus.
Engineered Products Sold with *Service*

AMERICAN HAMMERED *Industrial Piston Rings*

KOPPERS COMPANY, INC., ***Piston Ring and Seal Dept.,*** **1581 Hamburg Street, Baltimore 3, Md.**

Gentlemen: Please send me free 16-page booklet containing full information on Piston Rings.

Name.....

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WYMAN-GORDON furnished **the first** heat treated crankshaft, forged **the first** six-throw crankshaft, forged **the first** eight-throw crankshaft, forged **the first** crankshaft with integral counterweights, and today forges a larger quantity and a greater variety of crankshafts than any other company in the world.

In a crankshaft there is no substitute for a forging, and in a forging there is no substitute for Wyman-Gordon quality and experience

Crankshaft forgings illustrated, left to right, for V-8 passenger car, diesel truck and heavy tractor engines

WYMAN-GORDON CO.

Established 1883

FORGINGS OF ALUMINUM • MAGNESIUM
STEEL • TITANIUM

WORCESTER 1, MASSACHUSETTS
HARVEY, ILL. • DETROIT, MICH.

BOSCH FUEL INJECTION EQUIPMENT — SYMBOL OF WORLD RENOWN

BOSCH
GERMANY

The two millionth BOSCH Injection Pump has just come off the production lines. This jubilee is a striking demonstration of uninterrupted successful performance by a product ranking high among BOSCH's pioneering achievements. Only the creation of this pump made the quantity production of high-speed diesels practical at all. But the figure of two million BOSCH Injection Pumps is also the proud balance of a mass production involving more than 50,000,000 high-precision components. Together with the universally approved BOSCH diesel equipment such as nozzles, nozzle holders and filters, they are a visible expression of the proverbial

Dependability And Thoroughness

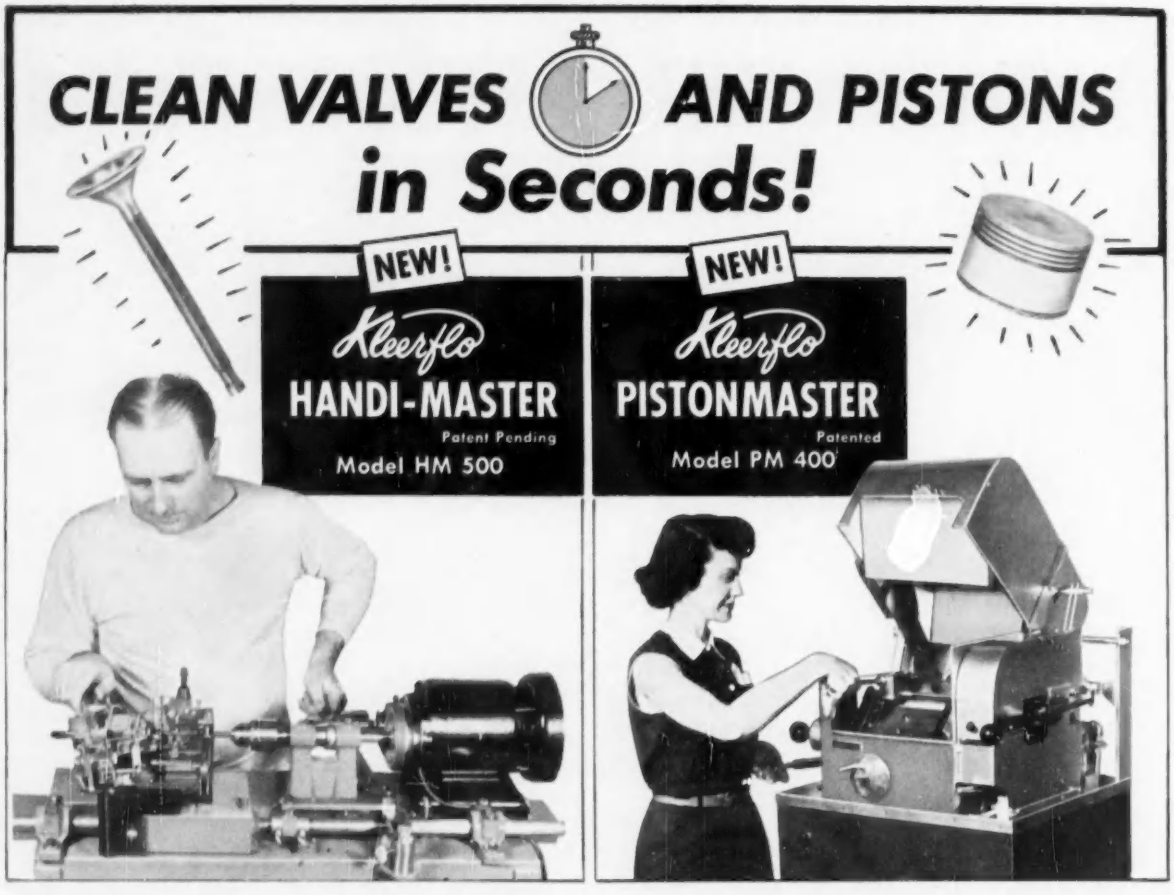
backing each individual BOSCH product

BOSCH AND THE DIESEL ENGINE ARE INSEPARABLE

EPM 155

ROBERT BOSCH GMBH STUTTGART (GERMANY)

CLEAN VALVES AND PISTONS in Seconds!



NEW!

Kleerflo

HANDI-MASTER

Patent Pending

Model HM 500

NEW!

Kleerflo

PISTONMASTER

Patented

Model PM 400

Valve cleaning time has been reduced to a new record time of ten seconds by the Kleer-Flo HANDI-MASTER that can also be easily converted to do a host of other important shop jobs.

The valve up to a ½" stem is locked into place in the chuck of the unit and is rotated rapidly by a ⅓ H.P. motor. A series of ingenious metal, spring-mounted cutters and scrapers then contact the valve to remove deposits from all surfaces, including those valves that have depressed crowns. No air compressor, cleaning device, or other power source is required.

The portable Kleer-Flo HANDI-MASTER can be wheeled anywhere in the shop and can be converted for many other shop uses such as a horizontal drill press or as a remote controlled sander, buffer, grinder or drill.

The time-consuming hand and abrasive methods of piston cleaning are now obsolete with the fast and thorough Kleer-Flo PISTONMASTER that will gently clean any piston now on the market or foreseen.

The Kleer-Flo PISTONMASTER releases skilled labor from a lengthy, tiresome and difficult chore, doing a more thorough and precise job in seconds than formerly was possible in hours.

A continuous flowing liquid solvent aids the cleaning action of the brushes in the unit. After reassembly, no sand or abrasive is present to endanger scoring cylinder walls and bearings.

A PISTONMASTER belongs in every service shop to drastically cut cleaning costs and add to profits.

MARINE AND STATIONARY ENGINES | CYCLES | AUTOMOBILES | MOTOR TRUCKS | DIESEL TRUCKS | AIRCRAFT

CLEANS ALL VALVES AND PISTONS USED ON THE GROUND AND IN THE AIR!

See Your Jobber or write for literature!

Practical Mfg. Co.

America's Foremost Producer of Parts Cleaning Equipment

2840 4th Ave. S, Minneapolis, Minn.

Torque Converter power-packages on three cranes

save $60.00 a day in fuel costs alone!

Close-up of Caterpillar D315 Diesel Engine, driving through a Twin Disc Model CF Torque Converter. This powerful combination is used by the Valentine-Clark Corporation of St. Paul, Minn., to power their Link-Belt Crane, shown below.

A Twin Disc Torque Converter, on each of three cranes, is saving the Valentine-Clark Corporation of St. Paul, Minn., $20 a day in fuel costs alone—or a total of $60 for all three.

This company chemically treats poles to prevent destruction by weather and insects. Logs are shipped in from the West Coast, debarked and then chemically treated. The three cranes are used to unload the logs into treating pits, and to reload them for shipment.

This equipment includes one Link-Belt and two American Hoist & Derrick Cranes—all of which are equipped with Caterpillar D315 Diesel Engines, driving through Twin Disc Model CF Torque Converters.

Each of the cranes has been converted from steam power, and since switching to the powerful diesel engine-torque converter combination, several advantages have been realized. According to Lawrence Martin, Superintendent of Valentine-Clark, "In addition to our $20 a day saving in fuel—*per crane*, we've *increased* production more than 20%. We've also *decreased* labor costs in eliminating time consumed to fire boilers, and to make water stops."

The next time you repower or purchase new equipment—*specify a Twin Disc Torque Converter* for a smoother, easier, more flexible flow of power (up to 6:1 multiplication) and for longer equipment life through cushioning of shock loads. *Your* production will *increase* . . . your costs will *decrease*. Contact your engine dealer for more information. Twin Disc Clutch Company, Racine, Wisconsin, Hydraulic Division, Rockford, Illinois.

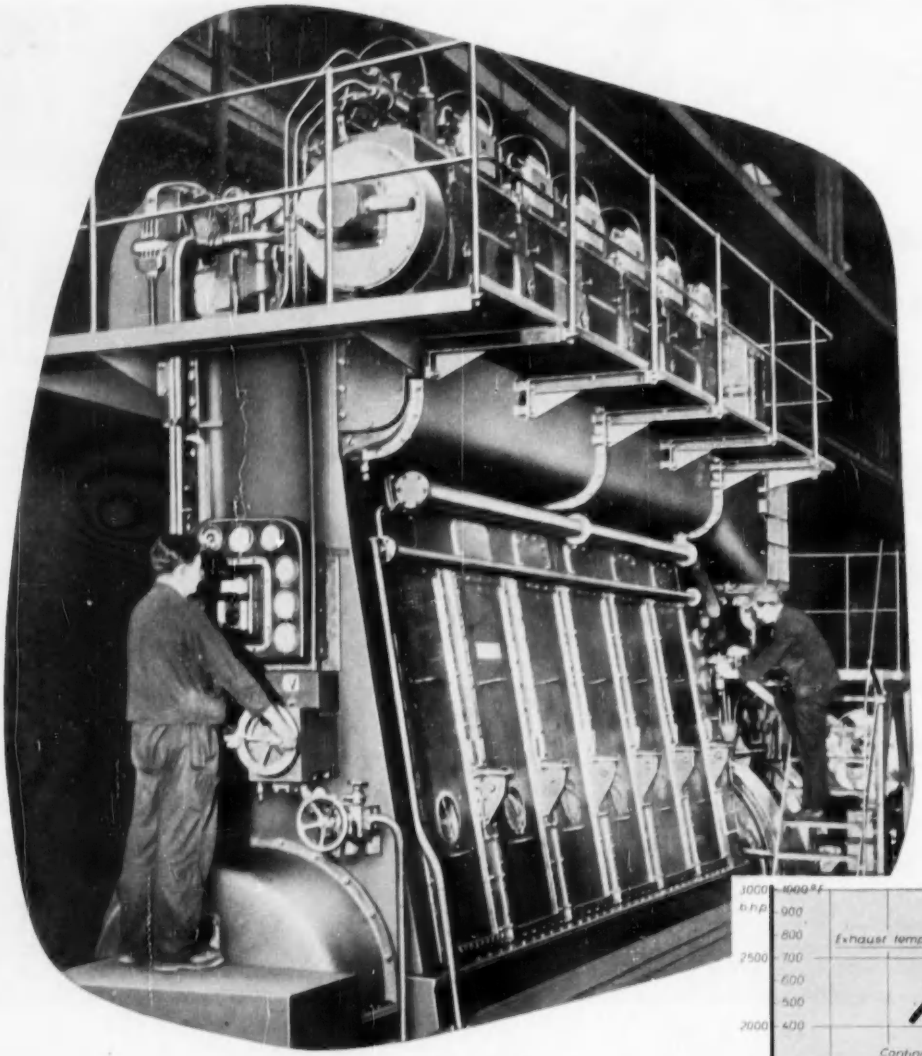
TWIN DISC

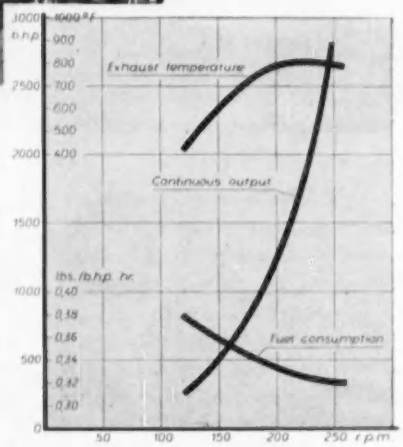
TWIN DISC

Torque Converters

TWIN DISC CLUTCH COMPANY, Racine, Wisconsin • HYDRAULIC DIVISION, Rockford, Illinois

BRANCHES OR SALES ENGINEERING OFFICES: CLEVELAND • DALLAS • DETROIT • LOS ANGELES • NEWARK • NEW ORLEANS • TULSA





High Supercharging and Operation on Heavy Fuel Oil

The engine type KV with high supercharging is designed for highest economy. It has an extraordinarily low fuel consumption. The crosshead design renders this engine particularly suitable for the combustion of heavy fuel oils. After long workshop tests this engine has proven its entire reliability in practical service as main propulsion engine for ships.

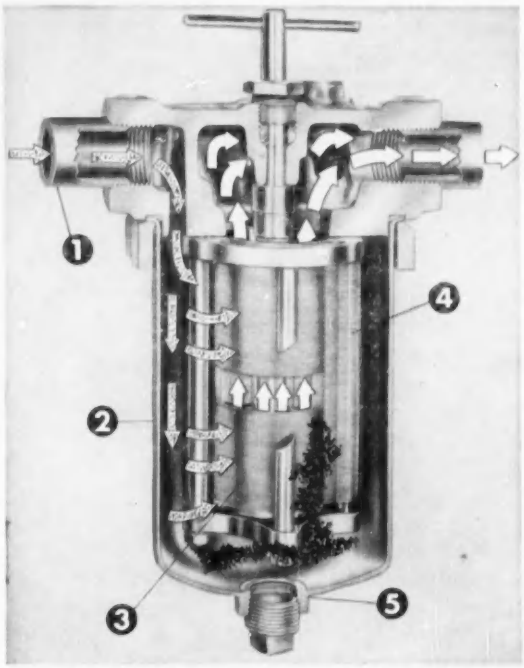
M·A·N

MARINE DIESEL ENGINE

MASCHINENFABRIK AUGSBURG-NURNBERG AG. · WERK AUGSBURG

Represented in all countries

New CUNO SUPER Auto-Klean Filter can boost engine life up to 50%



HOW IT WORKS. Dirty oil enters inlet (1) at left, fills housing (2) and flows through metal edge-type filter. (3) Clean oil rises through center of filter, leaves at right. Dirt combed out by cleaner blades (4) is removed through drain (5).

Here's what the U.S. Army has done to test Cuno's new 40-micron SUPER Auto-Klean filter for their engines:

They ran destruction tests on several identical engines equipped with different brands of filters. As they ran, dust was introduced into the air intakes. When compression fell to half its initial value, the test was stopped. Best life for engines equipped with cartridge-type filters was 60 hours.

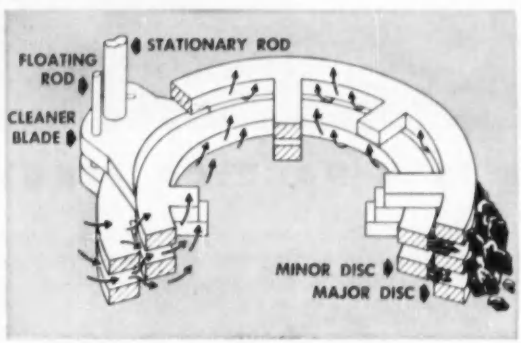
The engine with SUPER Auto-Klean ran 90 hours—50% longer—and *compression was still above half its initial value!*

You can get SUPER Auto-Klean now!

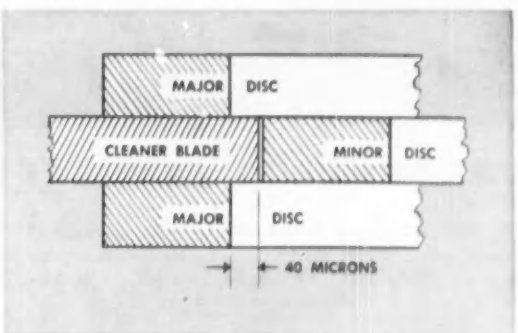
Just specify that the manufacturer equip your new diesel with this latest and best in filtration—both for fuel and full-flow lube. You'll get longer engine life and . . .

1. **Full-Flow** 40-micron filtration with a self-cleaning filter. No cartridge changes; filter can't rupture or channel.
2. **Low pressure drop.** An 8- by 2¼-inch filter element handles 30 gpm of 200 SSU lube oil with only 3 psi pressure drop. You get high capacity in a small package.
3. **All metal.** Can't absorb or adsorb additives from oil.
4. **No interruptions for cleaning.** Handles full flow all the time.
5. **Standard Auto-Klean housing.** On existing engines you can easily replace most 2¼ in. diameter cartridges with SUPER Auto-Klean or simply install SUPER Auto-Klean in the full-flow lube line following the discharge of the engine pump.

Write today for complete technical data on the new SUPER Auto-Klean for your new or existing diesel. Ask for Catalog No. SAK-057. Cuno Engineering Corporation, 9-1 South Vine Street, Meriden, Connecticut. 5.5



FILTER ELEMENT consists of stacked major and minor discs and cleaner blade bearing against precision ground minor disc. Oil flow is shown by arrows.



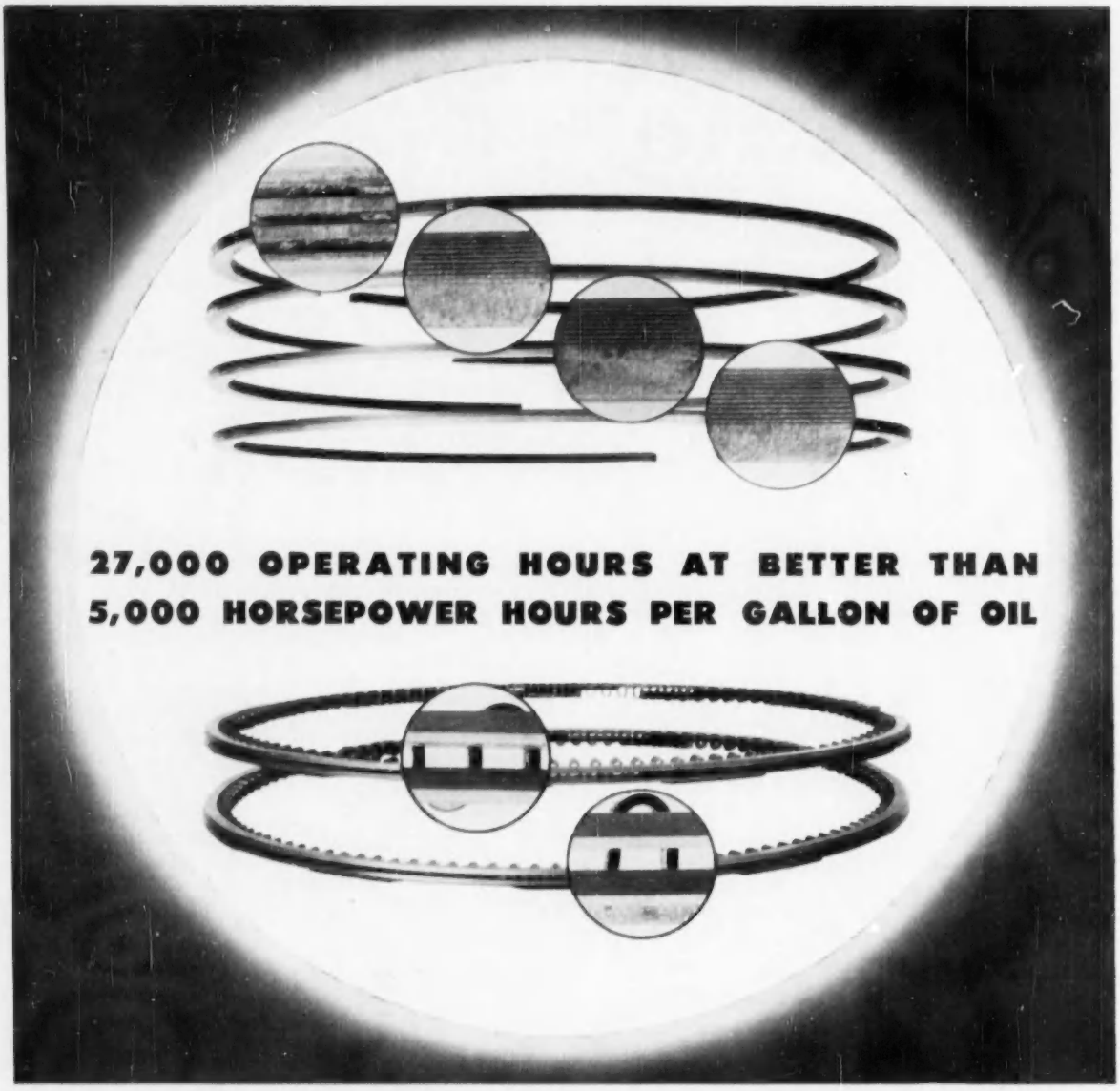
LARGE PARTICLES (over 0.012 in.) are stopped at space between major discs. Short 40-micron restriction stops 40-micron particles, but allows high flow rate.

CUNO

ENGINEERED FILTRATION

Removes More Sizes of Solids From More Kinds of Fluids

AUTO-KLEAN (edge-type) • **MICRO-KLEAN** (fibre cartridge) • **FLO-KLEAN** (wire-wound) • **PORO-KLEAN** (porous metal)



27,000 OPERATING HOURS AT BETTER THAN 5,000 HORSEPOWER HOURS PER GALLON OF OIL

ENGINEERED RING SETS IS A PEDRICK FIRST

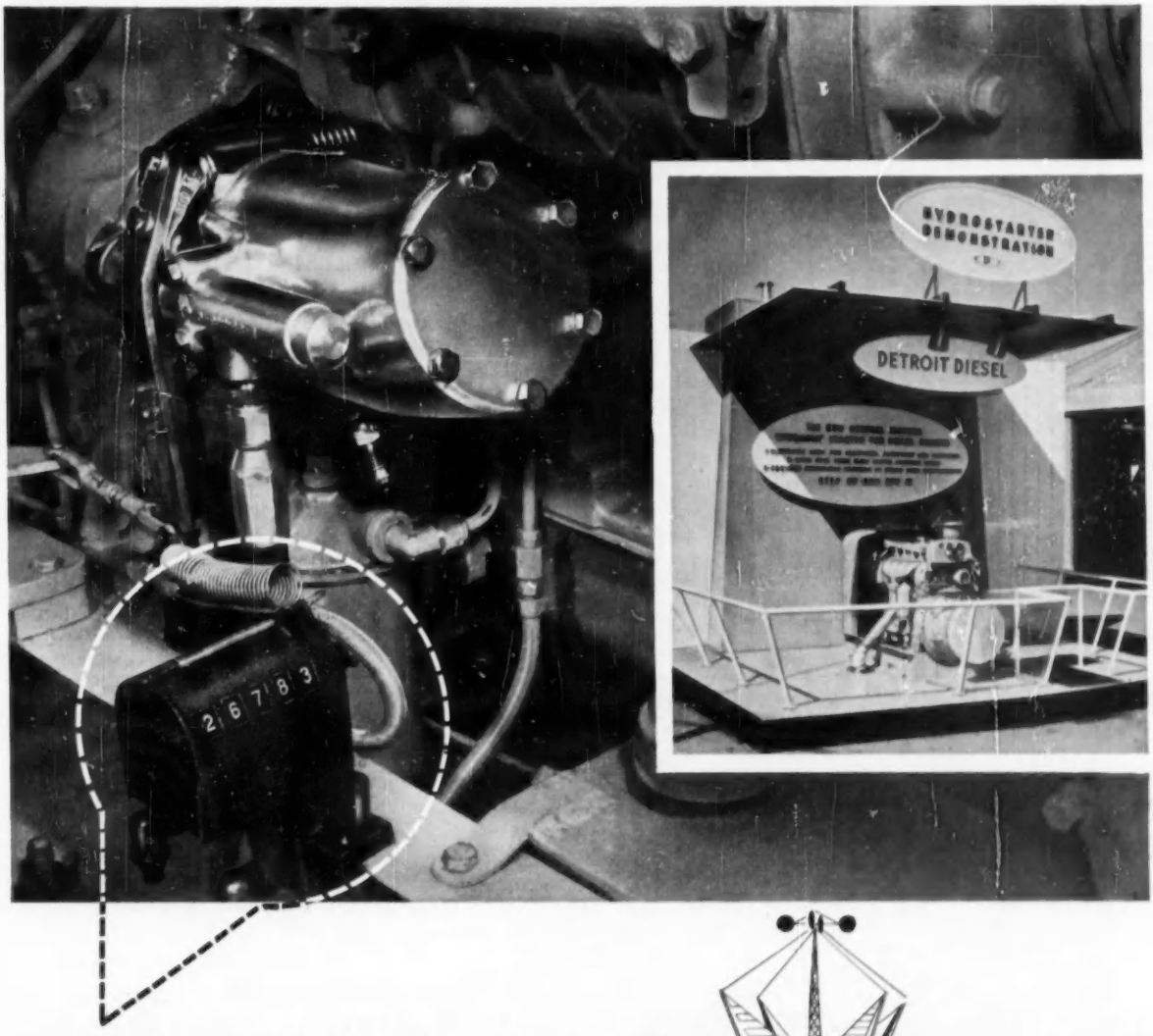
In 1921, the first complete set of rings in a single package, engineered for a particular internal-combustion engine, was introduced *by Pedrick*. You get 35 years of experience and know-how, therefore, in the complete sets we engineer for diesel and gas engines.

That's part of the reason Pedrick Engineered Sets give the kind of performance revealed by the un-retouched photo above. These rings are from a Pedrick E3902 Set taken out of a Cooper-Bessemer GMV engine after 27,109 hours of operation. Oil consumption averaged better than 5,000 hp. hrs. per gal. Wear in the cylinders was almost insignificant—averaging only .00725 in. at the top and .0035 in. at the bottom. Ring tension remains at practically original production level. Each ring shows face-wear only about halfway up, so rings still are practically as good as *new!*

For *your* engine's own good, use Pedrick Engineered Sets with the latest ring designs in proper combination, illustrated installation instructions, a single package per cylinder. You'll also enjoy the benefits of simplicity in ordering and stocking. The same engineering know-how which goes into Pedrick Engineered Sets is available to help you with special problems. Write, wire or phone: WILKENING MANUFACTURING CO., Philadelphia 42, Pa. SAratoga 9-3770. In Canada: Toronto 2.

Pedrick HEAT-SHAPED **PISTON RINGS**

PEDRICK PRECISIONEERING KEEPS PEDRICK FIRST



26,783 Starts in 26 days at GM Powerama!

HERE'S PROOF of the rugged dependability of a General Motors Hydrostarter—the new, low-cost hydraulic starting system now available on all GM Detroit Diesel engines:

> On public demonstration at the GM Powerama, a Hydrostarter started a GM Detroit Diesel 26,783 times in 26 days—an average of more than 1,000 starts per 12-hour day—more than 1 start every minute.

A Hydrostarter gets a GM Detroit Diesel up to starting speeds 80% faster than regular starting systems—costs less to maintain than electric starters—sells for a far lower price than any other non-electric Diesel starter.

And it gives you fast, sure starts—even at sub-zero temperatures, or when your equipment has been standing idle for long periods of time.

Call your GM Diesel Distributor for full details on the GM Hydrostarter—or write direct for more information.

DETROIT DIESEL

Engine Division of General Motors

Single Engines . . . 30 to 300 H.P.
Multiple Units . . . Up to 893 H.P.

America's Largest Builder of Diesel Engines

in DaRoS Piston Rings

Abrasives, technically known as "ferrites" and "cementites" (having a diamond-like hardness), are created in ordinary cast iron from the sulpher in the fuel used by the blast furnaces when making pig iron. Most blast furnaces use coke for fuel. All coke contains sulphur—as much as 1 to 5%. The higher the sulphur content, the greater amount of abrasives that iron will contain. All piston rings made of pig iron produced by coke, therefore have a high abrasive content—*Abrasives cause wear.*

Here's why there is 50 to 90% less wear with DaRoS Piston Rings

There are *no abrasives* in DaRoS Piston Rings because they are made from pig iron produced by blast furnaces using charcoal for fuel. Charcoal is a wood product and 100% free of sulphur. Thus, DaRoS Charcoal Iron, used exclusively in making DaRoS Piston Rings contains no "ferrites" or "cementites". To retain the original high purity of the Swedish iron ore, no outside scrap iron or steel is used in DaRoS foundries. That's why DaRoS rings are better—free of abrasives. Why DaRoS users enjoy 50 to 90% slower rate of wear on rings and cylinders in new and old equipment.

Discover the BIG Difference! Just ONE Installation Will Convince You!

DaRoS Rings are like no other rings you have ever before used! Their slower rate-of-wear means less "down-time"—thousands of more operating hours before renewals and re-conditioning. What's more, DaRoS Rings do *not* leak! That means operating economy like never before! You actually save 10% to 15% on fuel costs! Discover the *big* difference DaRoS Rings can make in your equipment. Write, wire or phone for recommended application and prices now.

IMMEDIATE DELIVERY FROM CHICAGO on Popular Sizes

(This is ad #9 in a series designed to tell Diesel Operators the important story about DaRoS Swedish Iron Piston Rings)

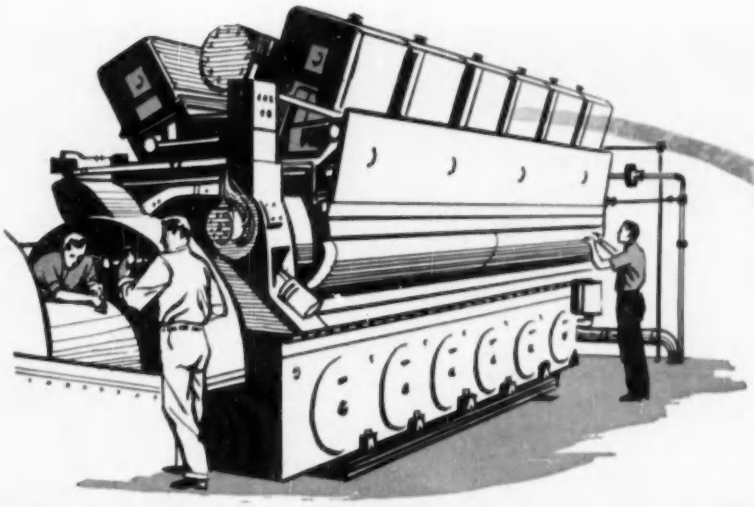
DaRoS

AMERICAN CORPORATION

D. D. Cook, President

8128 N. LAWNDALE AVENUE • SKOKIE (Chicago Suburb), ILLINOIS, U.S.A.

Distributors for North, Central and South America



BOOST DIESEL OUTPUT

with less fuel...less noise...less smoke

AiResearch Turbochargers give your stationary or mobile diesels more added horsepower than any comparable turbocharger or supercharger installation!

The application of AiResearch Turbochargers to stationary diesel equipment will overcome excessive noise and smoke problems... jump horsepower to a much higher level... and cut your fuel bills on a horsepower per hour basis.

In addition, it will restore operating efficiency for your diesel power plants at altitude.

Application of these finely engineered power packages to mobile diesel equipment is equally effective... as has already been demonstrated in the remarkable results achieved by the installation of AiResearch Turbochargers on Caterpillar diesel machinery.

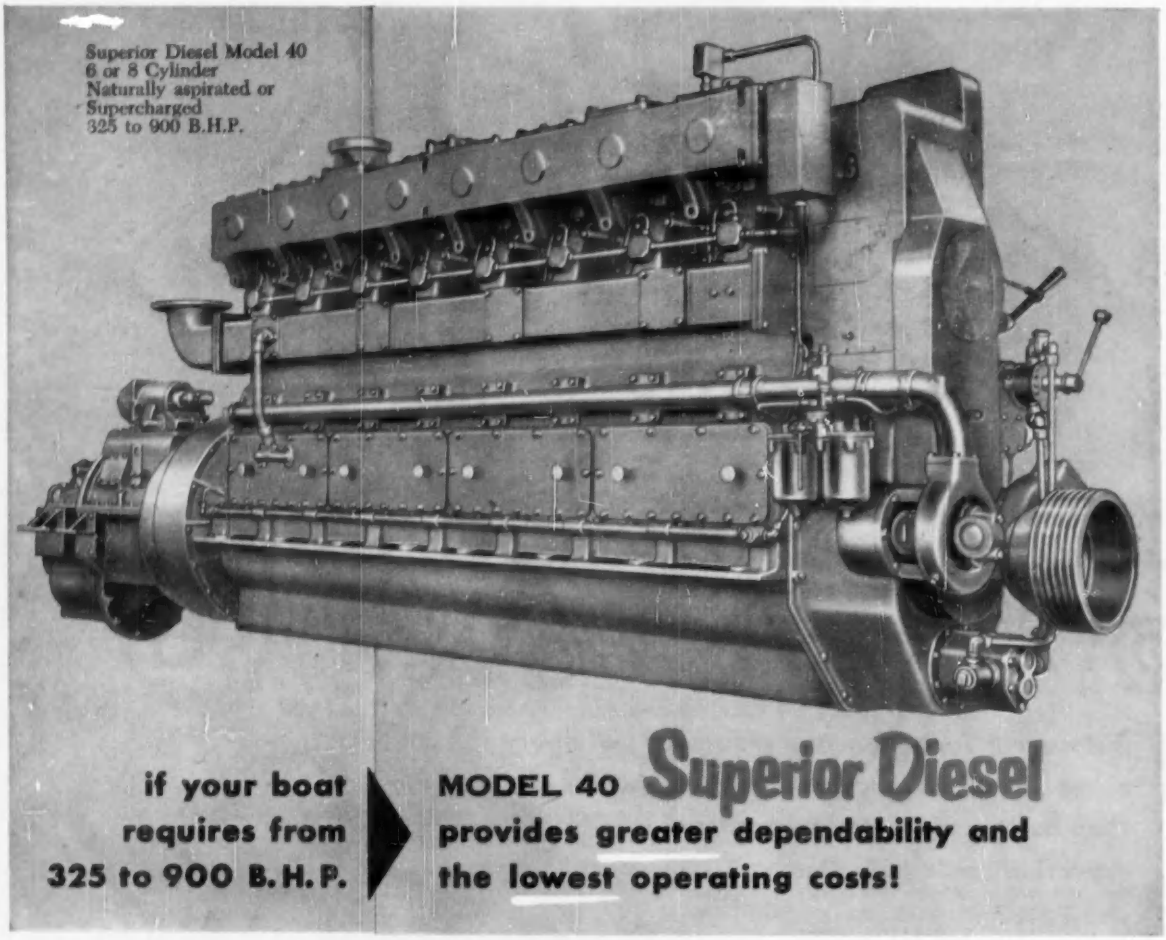
AiResearch is the largest producer of small turbomachinery in the United States, with twenty-five *million* hours of experience. This unmatched experience explains why AiResearch Turbochargers lead in power, economy and dependability. Your inquiries are invited.

THE GARRETT CORPORATION

AiResearch Industrial Division

9225 Aviation Blvd., Los Angeles 45, California

DESIGNERS AND MANUFACTURERS OF TURBOCHARGERS AND RELATED MACHINERY



For the utmost dependability and greatest operating economy in tugs, towboats, dredges, fishing vessels and other workboats, there's no better power plant than the Superior Model 40! This rugged, diesel engine can provide more years of trouble-free, profit-boosting performance at the lowest possible operating costs . . . . here's why:

FUEL SAVING COMBUSTION SYSTEM saves up to 35% fuel consumption compared with other engines in very similar hulls. Improved air intake and scavenging, combined with most ideally designed combustion chamber, make these big fuel savings possible.

STATICALLY-DYNAMICALLY BALANCED CRANKSHAFT carried on long-life, precision bearings provides practically vibration-free operation, reduces wear on engine accessories, permits faster acceleration.

EXTREMELY RIGID MARINE BEDPLATE resists hull distortion effect on engine, provides better alignment with propeller shaft thereby reducing vibration. It absorbs firing thrust, reduces stress on the block to greatly lengthen engine life.

SIMPLICITY OF RUGGED CYLINDER BLOCK provides larger than usual access to bearings, camshaft and fuel pumps for easier routine maintenance. Keeps downtime for servicing to a minimum.

INDIVIDUAL CYLINDER HEADS, LINERS, FUEL PUMPS are specifically designed for longest service life. This simplifies maintenance, provides greater performance dependability.

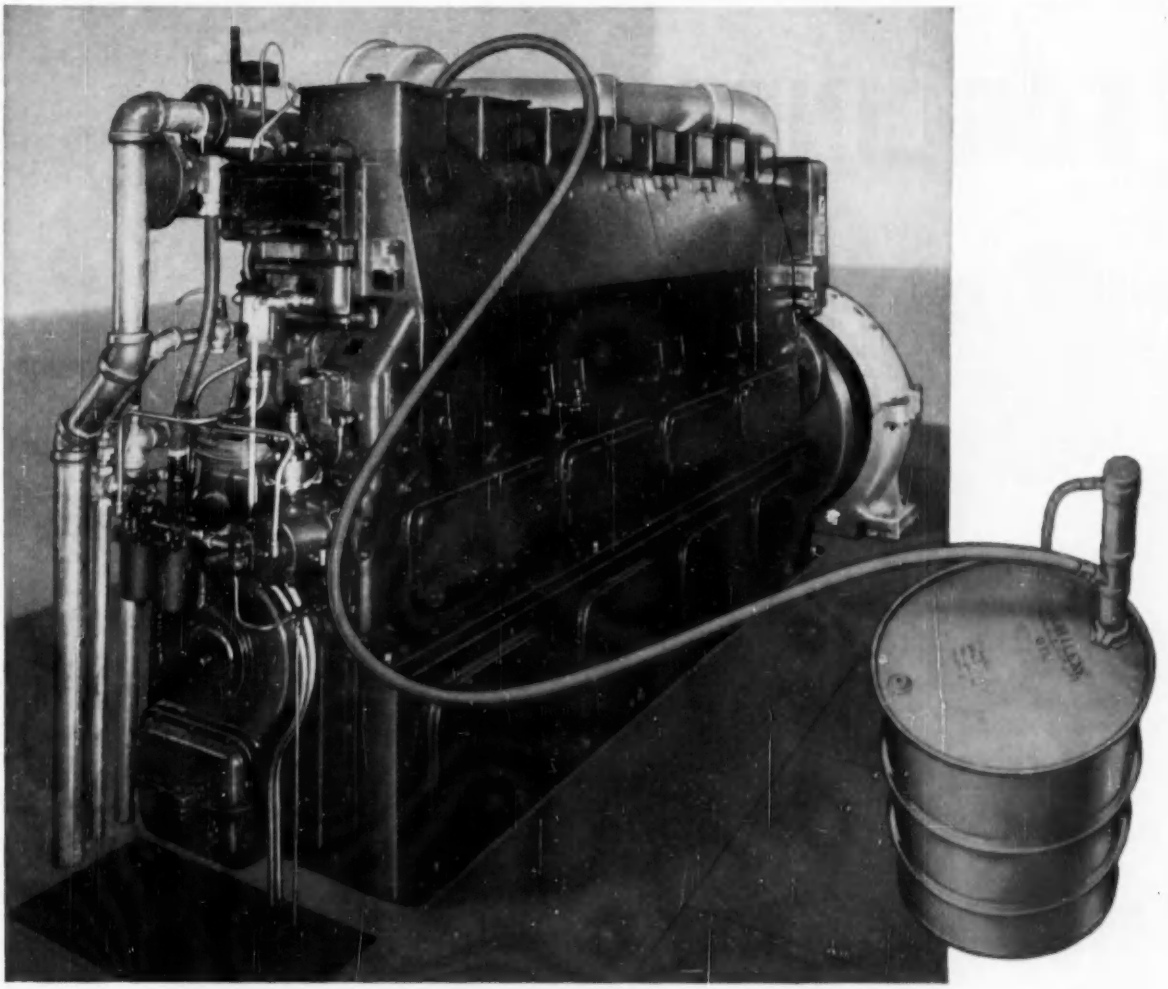
Whether you're choosing a diesel for a new boat or repowering, you can rely on the Superior Model 40 for longer service life, lowest maintenance, fuel, and lubrication costs! Get complete details at your nearest sales and service office listed below.

Superior ENGINES ATLAS Imperial DIESEL ENGINES White DIESEL

WHITE DIESEL ENGINE DIVISION

THE WHITE MOTOR COMPANY • ***Plant and General Offices: Springfield, Ohio***

SALES AND SERVICE POINTS: Gloucester, Mass. • Houston, Ft. Worth, Texas • San Diego, Oakland, Terminal Island, California • Ketchikan, Alaska • Washington, D.C. • Portland, Astoria, Oregon • Casper, Wyoming • Halifax, Nova Scotia • Vancouver, B.C. • Park Rapids, Minnesota • New York • Chicago • Seattle • New Orleans • St. Louis • Wichita, Kansas



Stops Thin-Out!

You can protect your Diesel against wear due to excessive thin-out of the lubricating oil at higher operating temperatures. Switch to Sinclair RUBILENE®, *the high viscosity index oil* proved by over 35 years in a wide variety of Diesel applications. You'll find RUBILENE holds its high film strength and reduces oil consumption . . . gives you better protection of cylinders, pistons, rings and other vital moving parts operating continuously for long periods. Your Diesel logs more full-power hours!

Switch now to RUBILENE. Regardless of the make of your Diesel, there's a member of Sinclair's famous RUBILENE or RUBILENE HD family that meets your needs exactly! Call your local Sinclair Representative or write for free literature to Sinclair Refining Company, Technical Service Division, 600 Fifth Avenue, New York 20, N. Y. *There's no obligation!*

SINCLAIR

RUBILENE OILS

FORGINGS WORTHY OF FINE DIESELS

The perfection of modern diesel and gas engines warrants only the best of components.

Ellwood City forgings meet the most exacting requirements of today's engine builders and operators. As suppliers of high grade crankshafts, and other important forgings for diesel and gas engines since 1910 we have developed know-how and facilities second to none.

Send us your forging specifications. We will meet them with price and product.

SINCE 1910

Aerial view of our 10-acre plant devoted exclusively to the manufacture of best quality, precision forgings for forty-seven years.

ELLWOOD CITY FORGE COMPANY

CRANKSHAFTS • CONNECTING RODS • MACHINE FORGINGS

ELLWOOD CITY, PENNA.

A Magazine as a Tool?

Repaired an engine last week. (Yup, ye Editor gets his hands dirty once in a while.) Had all the tools needed—torque wrench, sockets, box wrenches—the works. Job went through in a breeze. Looked up a few clearances and torques in the maintenance manual. Got to thinking . . . . maybe that book was the most important tool of the bunch. Saved a lot of fooling around and guessing. Might have saved a re-do too. Good idea for an editorial . . . . a book—no—a magazine as a tool. That's it. Been running a lot of good service and operating data . . . . getting more. We sweat over it—it should be used. Trouble is . . . . take that fellow who came in last week wanting information. Told him we published it two months before. Had a silly answer . . . . outfit only gets one copy of DIESEL POWER . . . . never got a chance to read it all. Fella looked like he could afford three bucks for a subscription of his own. One good idea a year would offset that tab . . . . and if that's all he gets, we're slipping. Besides, cost him more than that to come see us. Ought to get a copy sent home like others do. Then you get a chance to really see what's in it. Some encouraging signs though. One letter writer praised our lube oil and filter change series. Did more than that—sent in a flock of subs for his field men. Others wanted to reprint or buy reprints. Shows they're reading the book and using it. That's what we want . . . . come to think of it, our circulation man will love you too. One copy in a big company or whole department? Ridiculous . . . . sorta like one kit of tools in a busy shop. Even kids have their own school books for learning and reference. If it weren't for printed material, we'd all have to learn the hard way . . . . pretty expensive and time-consuming. Books and magazines are shortcuts . . . . cheap way to get a lot of data—fast. Put your industry magazine in your personal tool kit . . . . valuable and costs about as much as a good wrench.

B P E

Sealed Power
CHROME-FACED
Cyclan®

PISTON RINGS
are unequalled for Diesel engines

Cyclan ring iron, developed by Sealed Power metallurgists, has acquired an enviable reputation for Diesel service. Cyclan has many advantages, all of which are summed up in the simple, often-proved statement—CYCLAN WON'T BREAK IN SERVICE.

Now several of our Cyclan customers are ordering chrome-faced Cyclan rings, combining the heat-resistance and wear-resistance of chrome with the strength, wearing quality, resilience, and bearing characteristics of Cyclan.

This combination may be the perfect one for your Diesel engines. Sealed Power engineers will welcome an opportunity to discuss the subject with you at your convenience.

Write for "The Cyclan Story"

SEALED POWER CORPORATION
MUSKEGON, MICH.

Sealed Power

PISTON RINGS • PISTONS
CYLINDER SLEEVES

highlights

Sales of diesel fuel for highway use in New York State totaled 43,515,992 gal for the first nine months of 1955. This is in comparison to the 39, 989, 938 gal of a like period, a year earlier. At six cents per gal, the state tax on 1955 sales amounted to more than 2½ million dollars.

Pipe lines the the third largest ton-mile movers of all forms of commodity transport, according to API. At present, a network of more than 186,723 miles of petroleum pipeline crisscrosses 44 states and the District of Columbia.

"Largest number of locomotives on order since March, 1953", sums up a recent report from AAR concerning the number of new locomotive units on order as of December 1, 1955. A look at DIESEL POWER'S forcast for 1956 diesel engine sales (next page) will give you an idea of what to expect this year.

Plenty of notice for ARBA show—Just before the American Road Builders Association was scheduled to hold its annual convention at Miami Beach, Fla., announcement of the 1957 ARBA Road Show was made. The date and place—Jan. 28th to Feb. 2nd, 1957 in the Chicago Amphetheater.

CNR's first step toward complete dieselization was announced recently with application for a construction permit for a 30,000-gal oil storage tank. The road expects to complete the change over from steam to diesel by this spring.

Dr. W. W. Chao of Ford Motor Company's Engineering Staff recently discussed a simplified method of designing small, compact heat exchangers for gas turbine engines.

During the last 17 years, GM's Detroit Diesel Engine Division has produced over seven times the number of diesel engines produced by the entire American diesel engine industry over a 39-yr period prior to 1937.

Just 15 years ago, diesel locomotives carried a mere one-twentieth of one per cent of all rail freight. Now they pull nearly 85%.

Kenworth announced the delivery of five conventional highway trucks to the Coast Transportation Co., of Portland, Oergon. The rigs are powered by 250-hp turbocharged diesels. In addition to the five new trucks, the firm operates 33 other Kenworth rigs.

GE tells us that 23% of all installed power generating capacity 25 years from now will be atomic. Samuel Untermyer II, reactor designer in the company's Atomic Power Equipment Department told the National Industrial Conference Board that atomic generating capacity will be doubled every four years between 1960 and 1980.

From ASME we hear that trends in development of the industrial diesel engine indicate that this prime mover' high thermal efficiency will be further enhanced by advances made in the fuel injection and combustion processes.

Ireland's rail system marked its first steps toward complete dieselization, by accepting delivery of the first of 94 diesel-electric locomotives called for by the conversion from steam to diesel.

It takes oil to find oil according to API. The same type diesel-electric power plants that haul freight and passengers on 200 railroads throughout the nation are now used to drill wells and pump mud in the oil fields.

Today, more than one fourth of the railroads in the United States are completely dieselized. Still others are nearing completion of the changeover to modern diesel engines.

An oil well drilling rig, often as high as a 15-story building, is so skillfully engineered that it can lift and lower equipment weighing as much as five locomotives.

1956 Outlook

How many diesels
Where will they be used

Prior to 1951 there had long been a need for a measure of production and application of diesel, dual fuel, and gas burning engines. Lacking any fully coordinated effort along this line, the Industry welcomed the first report of the Andrews' Board study put out by Diesel Publications, Inc. in 1951. This report gave the forecast of engine production for 1952.

Each year since then a similar report has been prepared and distributed to the entire diesel field. And each year the demand for extra copies has increased, indicating the growing usefulness of this service. The popularity of the "Outlook" is further attested by the large number of requests for copies filed in advance of publication.

Herein are the results of the current study of the diesel industry with projections for 1956. Estimates for 1955 production, as this report goes to press some two months before the year-end indicate the industry will finish the year within 1.3% of its 1955 goal. The essential findings of the Andrews' study will be found on the following pages. The closing pages carry recapitulations of engine sales and total horsepower (estimated), broken down by applications for the past five years and projections for 1956.

Although 1955 was a good year for the diesel engine industry, the board of analysts of Future Sales Ratings visualizes the year 1956 as bettering the sales record of 1955 in each of the nine major categories of diesel engine application: railroad, marine, highway transportation, municipal and utility, general industry, petroleum, mining, construction, and agriculture.

This is the first time in years that the prospect of sales increase has been applicable to all categories of diesel users. Even agriculture, which has been somewhat of a declining market in recent years is expected to increase its take in 1956, as compared with 1955. Over-all, the comparatively excellent year ahead is foreseen as bringing a two to five % sales gain over the favorable year 1955, with a possibility that the higher figure could be exceeded if advertising and selling by the diesel engine industry is extensive enough and strategic enough. A strong base of potential demand is seen as existing for the diesel engine industry, but competition—both internally and externally affecting the industry—is likely to be at a new peak in 1956.

As far as external competition is concerned, the diesel engine continues its strong position. The basic characteristics of the diesel engine, including power, maneuverability, ready adaptability anywhere, efficiency and economy, still favorably impress the board, which recognizes the diesel engine as one of the outstanding avenues for cost reduction and savings by American business. For the next 12 months, the diesel engine industry is given the top, five-star potential sales rating. Discussion of the principal classifications of prospects and their potential takings for 1956, with comparisons for 1955 and 1954 follows:

Railroads

The railroads have gone a long way in dieselization and the results have been effective indeed. At present about 75 Class I railroads perform 100% of their freight service gross-ton miles by diesel power; 25 more use diesels for more than 90% of their freight service and 10 use diesels for more than 80%. Thus, 111 of the 127 Class I railroads now take care of over 80% of their freight service by diesel locomotives.

Some members of the board are strongly in favor of building more reserve capacity in diesel locomotives. They feel that full use of our present economic potential would create a domestic traffic burden far in excess of anything encountered up to this time. The expansion would be large and rapid, and there is no such reserve of idle capacity as existed, say, at the beginning of World War II. Diesels are unusually long-lived but many of the early units are now ready for retirement or thorough rebuilding.

Railroads had a fine year in 1955, and this was reflected in some increase in diesel-electric units installed, despite the already high existing degree of dieselization. It must be realized, too, that some of the railroads—principally those dependent on coal traffic—will be holdouts on diesel power for some time.

For the year 1956 an improved picture is visualized, as indicated by statistics below. The estimate for 1955 is based upon actual installations of 590 units in the first six months of the year and the number on order. The estimate of 1,300 units for 1955 is based on the hope that rail traffic will maintain a sufficiently high level in 1956 to warrant the installation of a few more locomotive units than were placed in service in 1955.

New diesel-electric units installed in 1954 and estimated for 1955 and 1956 follows:

	Railroads		
Year	*Class 1*	*Others*	*All U.S. Railroads*
1956 Est.	1300	55	1355
1955 Est.	1100	51	1151
1954	1097	43	1140
1953	2122	79	2201
1952	3035	105	3140
1951	3490	172	3622

Highway Transportation

Reflecting the business boom, truckers handled about 10% more intercity tonnage in 1955 than in 1954. Continued increases in ton-mileage and revenues are forecast. With regard to intercity buses, traffic is down somewhat, but revenues are steady, reflecting higher rates. Private cars are continuing to affect regular route travel. In general, the downward trend had ended before the end of 1955, and prospects are considered favorable in the light of fare advantages and convenience represented by most bus lines.

Diesel engine factory sales (including exports) by truck manufacturers totaled 15,200 in 1955, compared with the board's estimate of 15,500 for 1956. For diesels in buses, the comparative figures are estimated at 3,100 for 1955 and 3,300 for 1956.

A basis for further expansion in these fields is the gigantic highway program now in the making. Whether it is President Eisenhower's plan or some substitute measure, a huge Federal highway project is a vital certainty. Meanwhile, many states are proceeding on their own to finance highway construction. The program of providing Federal aid to highways should give special emphasis to the Interstate highway system. The great success of toll roads is encouragingly indicative.

Diesel Sales for Highway Transportation

Year	*Truck*	*Bus*	*Total*
1956 Est.	15,500	3300	18,800
1955 Est.	15,200	3100	18,300
1954	10,540	2732	13,272
1953	13,584	2805	16,390
1952	14,689	3157	17,846
1951	17,103	4662	21,765

Marine

Although the outlook for diesels in ocean-going tonnage appears to be no more promising in 1956 than it has been during the last decade, a substantial boom in the building of smaller diesel-powered vessels is expected to continue. In fact, all signs point to intensified activity in this segment of the marine field. Low rates and improved equipment, nearly all of it powered by diesels, are helping to boost river and coastal traffic to new all-time peaks each year. The nation's vast network of inter-connecting waterways is being further extended, further developed, and heavy industry becomes more and more conscious of transportation advantages offered by waterside locations. By the end of 1955, the board believes last year's record of 80,000,000,000 ton-miles chalked up by domestic water carriers will have been surpassed by 20-25%.

The market for marine diesels in the fishing fleets should remain relatively stable despite a tapering-off in the construction of shrimp boats. In any case, a brisk demand for a wide variety of vessels supporting the off-shore drilling industry should more than take up the slack. Also, there are two other factors that could begin to exert a strong influence on marine diesel sales in 1956. These are the increasing interest in roll-on/roll-off vessels which if built to approved designs are eligible for 87½% government financing, and the more advanced planning of small freighters and tankers for operation on the improved St. Lawrence Seaway.

Diesel Sales In The Marine Field

	Vessels Over	*Diesels for*	
Year	*100 Gross Tons*	*Smaller Vessels*	*Totals*
1956 Est.	100	2450	2550
1955 Est.	90	2319	2409
1954	96	2225	2321
1953	126	2119	2245
1952	114	1966	2080
1951	81	2162	2243

Municipal and utility

Today, it is the rare municipality that is not heavily pressed to keep up with the demands of a rapidly increasing population. Requirements call for more and more power, with diesels justifiably considered a major source of energy for municipal power plants. Total spending by public utilities for expansion of new plant and equipment in 1955 approximated $4,390,000,000, compared with $4,219,000,000 in 1954. The year 1956 is likely to see this total advancing to at least $4,500,000,000. Some of these expenditures are for buying diesel engines for such activities as peaking, end-of-the-time, and standby.

The municipal market potential for diesels is steadily expanding, and encouraging to note, too, is the fact that municipalities' ability to finance such equipment is advancing as some projects are placed on a pay-as-you-go basis and tax revenues increase with population growth and prosperity. In addition to electric power generation, municipalities use diesels, dual-fuel, and gas engines for miscellaneous other purposes, such as drainage pumping, sewage disposal, pumping of potable water, as well as sanitary systems and pumping of gas for cooking and heating. Installation figures of diesel engines follow:

Municipal and Utility

Year	*Installations*
1956 Est.	450
1955 Est.	443
1954	425
1953	392
1952	355
1951	450

General Industry

Many prospects in this growing diesel market believe that, essentially, the opportunity to cut costs by adopting the latest capital goods and techniques is the key to economic progress. Availability of a lower priced or better quality product helps to broaden the market and raise living standards. A wide variety of diesels help in this respect—ranging from the big engines found in ore reduction and metal fabricating plants to the small emergency standby units.

The board visualizes growing potentials in such expanding markets as primary iron and steel, which spent about $800,000,000 for new plant and equipment in 1955, primary nonferrous metals spending $300,000,000 annually, stone, clay and glass products industries spending $410,000,000, textiles at $290,000,000, paper and allied products at $450,000,000, beverages and food products at $700,000,000, chemicals and allied products at $1,150,000,000, petroleum and coal products at $2,800,000,000 and rubber products at $140,000,000.

All these businesses and industry in general maintain a strong financial condition and represent potentials which the diesel engine industry can tap substantially further than they have in the past. Working capital of American corporations is now at an all-time peak near $100,000,000,000, with current assets alone more than twice the entire current liabilities. The board foresees a better year here in 1956 than in 1955.

General Industry

Year	*Engines*
1956 Est.	13,500
1955 Est.	12,800
1954	11,200
1953	15,780
1952	12,987
1951	13,146

Petroleum

This is one of the most virile industries in the country, and its stake in the diesel engine industry is two-pronged, since diesels represent a principal market for its output and diesels also are being used more extensively in the production and distribution of petroleum products.

Applicability of a diesel-electric power plant to drilling holes and pumping mud for the petroleum industry is a well established fact, and it may give the diesel industry an added fillip in the future. Of the 3,000 or so oil drilling rigs in country, many use old type steam engines and boilers and others have diesel engines using a mechanical drive. The newer application is use of diesel power to run generators which in turn supply power for electric motors to work the drilling or pumping equipment, on a principle similar to diesel-electric locomotion in the railroad industry.

The petroleum and related industries spend over $1,000,000,000 annually for all plant and equipment needed. Virtually every division of the petroleum industry uses diesel or gas engines. In some instances these are reported in other classifications, i.e., the numerous diesel-powered trucks will be reported under "Highway Transportation", with tanker engines included under "Marine". A steadily rising demand is foreseen for this industry as aircraft, cars, trucks, oil burners, lubricants, and diesel engines rapidly advance on the American scene.

Petroleum

Year	*Engines*
1956 Est.	5075
1955 Est.	4630
1954	4310
1953	4280
1952	4164
1951	3903

Mining

This industry faces a bright future and is correspondingly a favorable market for diesel engines. The nation's great, expanding economy will have more and more need for basic raw materials, creating pressure on this industry for greater production and therefore additional equipment.

Uranium mining is a big new stimulus. Due to the isolated locations of uranium mines, diesel power is a "must" for ventilation, pumping, drilling and haulage. The Colorado Plateau area alone (107,000 sq. miles) has almost 600 producers shipping uranium ore. Ore production has doubled every 18 months and will continue to rise.

Other branches of the industry have expanded at a slower rate, but they are an attractive market for diesel engines, particularly in view of the continuing trend toward the use of diesel haulage in underground mines and the trend toward open-cut mining wherever possible—generally requiring diesel-powered equipment because of the distance from electric power lines. Diesel popularity not only has been growing underground but also in the advancing open-cut and strip-mining field. Over-burden is effectively removed by diesel-powered bulldozers, scrapers, shovels, draglines, slack line cableways and trucks. This huge industry of the U.S. and Canada is spending at the rate of almost $1,000,000,000 annually for all new plant and equipment, and the country's mining interests are developing further expansion plans.

Mining

Year	*Engines*
1956 Est.	3925
1955 Est.	3468
1954	2953
1953	2635
1952	1950
1951	2325

Construction

This industry reached a great new peak of activity in 1955, with expenditures for building of all sorts exceeding $40,000,000,000. Much more has to be done in this field to catch up with the growth of the economy, rise of population, road needs and the overscarcity of schools, churches, hospitals, and other institutions, sewage systems, etc. Over 40% of all the nation's plant and equipment is of postwar date, with more than half of it acquired during World War II or before. About three-quarters of all the structures in the country are more than 8 years old, including apartment houses, stores, warehouses, office buildings, factories and other industrial plants.

Roadbuilding, when the program eventually begins, will represent a huge market for diesels. At present some 300,000 pieces of construction machinery and allied equipment were available for use by the 6,000 or so contractors who worked on the nation's roads last year. This equipment already is in very heavy use as roadbuilding is high even without the stimulus of the big new Federal program. Contractors will have to add considerably to their present stock of equipment—especially with the high premium placed on time and the new more powerful machinery constantly being developed by the "Big 4". Smaller contractors ($1,000,000 sales) are entering the roadbuilding picture, many for the first time, again placing a premium on the latest type equipment. In an election year, much attention will be focused on the future roadbuilding program.

Construction

Year	*Engines*
1956 Est.	31,000
1955 Est.	28,700
1954	26,200
1953	28,400
1952	25,286
1951	28,583

Agriculture

Diesels in use on farms took a heavy battering in 1955, when record-breaking crops, on the whole, were produced. As prices of most farm goods sagged in recent years and farm income declined, farmers cut their equipment purchases materially, but even with no great improvement in income, machinery must be replaced as the wearing process goes on.

Although his income has declined, the farmer is by no means in poor financial condition. Years of prosperity during World War II and since have resulted in heavy payments of mortgage and other debts and the farmer's present ratio of cash and current assets is favorable. Total agricultural income for 1955 was off just slightly from the $15,800,000,000 total of 1954, indicating the likelihood of a turn for the better in the agricultural picture and therefore an increased demand for farm machinery and diesel engines.

The farmer, too, is ever-interested in the opportunity to increase efficiency and cut costs. He does not necessarily wait until his equipment is worn out; new features, greater capacity and improved design kindle his desires just as they do a consumer shopping for a new car. Since such improvement in farm machinery has been progressing very well indeed, there remains only greater effort and ingenuity in advertising and selling to expand this important market.

Agriculture

Year	*Engines*
1956 Est.	41,000
1955 Est.	40,520
1954	43,307
1953	58,158
1952	68,327
1951	70,000

Breakdown by fields of application of the estimated engine sales for 1955 with comparative figures for the preceding five years.

	Estimated 1956	1955	1954	1953	1952	1951
Railroads	1,355	1,151	1,140	2,201	3,140	3,662
Highway Transportation	18,800	18,300	13,272	16,390	17,846	21,765
Marine	2,500	2,409	2,321	2,245	2,080	2,243
Municipal & Utility	450	443	475	592	555	450
General Industry	13,500	12,800	11,200	15,780	12,987	13,146
Petroleum	5,075	4,630	4,310	4,280	4,164	3,903
Mining	3,925	3,468	2,953	2,635	1,950	2,325
Construction	31,000	28,700	26,200	28,400	25,286	28,583
Agriculture	41,000	40,520	43,307	58,158	68,327	70,000
TOTALS	117,655	112,421	105,128	130,481	136,135	146,077

NOTE: Figures are estimated sales of all sizes and types of diesel, dual fuel, and gas burning engines.

A consolidation showing horsepower estimates for the 1955 projected engine sales figures in each of the nine usage fields based on the estimated horsepower range and unit average for each field.

			1956 Projected Engines	Estimated Horsepower
Railroads				
Horsepower Range 200-2400	Estimated Average 1200 H.P.		1,355	1,626,000
Highway Transportation				
Horsepower Range 120-200	Estimated Average 140 H.P.		18,800	2,632,000
Marine				
Horsepower Range 165-4800	Estimated Average 400 H.P.		2,550	1,020,000
Municipal & Utility				
Horsepower Range 200-3600	Estimated Average 1250 H.P.		450	562,500
General Industry				
Horsepower Range 60-3600	Estimated Average 300 H.P.		13,500	4,050,000
Petroleum				
Horsepower Range 60-2400	Estimated Average 300 H.P.		5,075	1,522,500
Mining				
Horsepower Range 60-550	Estimated Average 150 H.P.		3,925	588,750
Construction				
Horsepower Range 60-550	Estimated Average 150 H.P.		31,000	4,650,000
Agriculture				
Horsepower Range 30-180	Estimated Average 75 H.P.		41,000	3,075,000
			117,655	19,726,750

Our Changing Industry

Our industry today and some of the factors that shaped and are still shaping its course.

By Brian P. Emerson, Editor

TODAY'S accomplishments had their roots in yesterday. Tomorrow's seeds are planted today. So if we review what has happened in the past few years and is taking place right now, a pattern emerges as a sign post leading into the future. Well, what has happened?

First, perhaps you'll pardon a personal note. The editor's role is one of observer and reporter. He's supposed to know his industry and fortunately for him he has access to a broad range of industry-wide information. Now everyone works with his tools—sliderule or wrench—and industry data is the editor's kit of tools. His end-product is his magazine which is bound to reflect these "tools". So we'll take the liberty of footnoting articles from DIESEL POWER to form a sort of bibliography.

If a "Hoover-type" commission was assigned to study the pattern of the diesel industry since World War II their first reaction would most likely be an awareness of change—great change. Studying the causes would reveal two broad influences—a wide range of external factors that affect both the market for and types of diesel engines in demand, and internal industry factors.

External Influences

When you consider the tremendous economic expansion in the past decade, you cease to wonder at the changes. You might wonder instead how industry managed to adapt itself to meet the challenge. The diesel industry is no exception; it adjusted rapidly to the changing times.

You can take just about any facet of our national life and economy and relate it to some phase of our industry. It is just a question of how far afield and how deeply you want to go into the matter. We plan to highlight some of the major influences to start you thinking. You can fill in any gaps and round out the picture.

Our whole economy is affected by the international situation so this is a logical place to start. Next we can consider the impact of national programs and legislation, and project this down to the state level. The status of our economy is important because of its effect on such things as power demands, transportation, etc. Then we might well talk about fuels since they are fundamental to all industry. Finally, there is an important influence —the user—who can sway the course of any industry.

International Situation

Korea and the obvious intent of Russia brought on the cold war (or hot peace, if you like) and a buildup of our defenses. There is hardly a phase of our military program in which diesels are not involved.

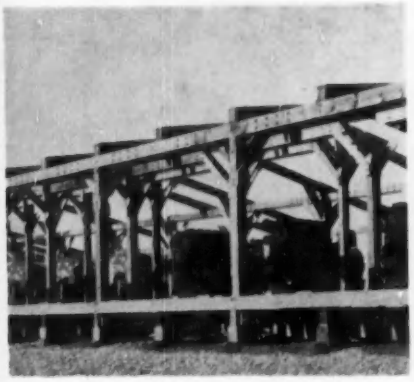
Thule,[1] other Greenland and Icelandic bases, Spanish, North African and Turkish bases are just a few of our vital installations. Early-warning radar screens, aerial navigational systems and communication networks are another type. Diesels supply primary power and in some cases, standby power. Our growing number of Nike sites are a good example of the latter.

Swinging from defensive measures to tactical application of diesels in either a direct or support role, we need only mention a few typical uses. The bulldozer—potent weapon of World War II fame—is still the backbone of the Engineer Corps' construction equipment that builds the roads, air strips, and installations on which tactical forces depend. Our Navy relies heavily on diesels to power their auxiliary craft, landing craft and despite nuclear advances, the bulk of our submarine fleet.

The Air Force depends on diesels for a wide range of uses. They provide the power for many ground installations and many tactical and strategic planes depend on diesels to supply power for ground-checking instruments and starting the jets.[2] And their navigational aids and communications take a lot more engines.

All this has been responsible for a good diesel engine market. It has also influenced types and characteristics of these engines through factors such as the wide range of applications and specification criteria. Various agencies are changing or compromising their criteria to take advantage of technological break-throughs and where special engines are needed, are stimulating research through development contracts.

A final effect of the international situation concerns



Installing Ingersoll-Rand diesels at Thule Air Force Base, 900 miles from North Pole.

A "Cat" engine gets an air lift, emphasizing importance of engines with high output for their relative size and weight.

Mobile power units solve disaster, distribution and emergency problems.

mobilization planning.[3] Those who have gone through a mobilization know all about the snafu's that occur. We're kidding ourselves if we think that it wouldn't happen again should the final eventuality occur, but today's planning is much more realistic. There is a workable planning framework in being.

Two phases of the overall plan will affect the diesel industry. Both come under the heading of "standardization" although there is a difference. First, the Engineer Corps Research and Development Labs at Fort Belvoir, working with industry and other agencies, is setting up "families" of engines with a maximum number of interchangable parts. Progress with the smaller gasoline engines has been good and diesels are being tackled. Secondly, high-priority end-product items with the larger engines as components are programmed to reduce the number of engine types in one class of item. Production capabilities are figured in the planning.

Domestic Legislation

Broad policies have set up a favorable climate for a high level of business activity. Even social legislation—Wage and Hour laws, Social Security, etc.—has put more money in the people's hands and given them time to spend it. One result has been the tremendous increase in the electrical power consumed per capita due largely to all the labor-saving devices. Another result is the flood of car buying that has made the inadequacy of our road system acute. Let's talk about these two (of many) results.

With increased electrical demands, plants are out or are running out of firm capacity. In municipal power plants this generally means more engines. Even public utilities are feeling the pinch[4] and with current trends toward both industrial and residential decentralization are running into distribution problems in fringe areas. Production of diesel power packages[5] and mobile power units has been stimulated by this distribution problem.

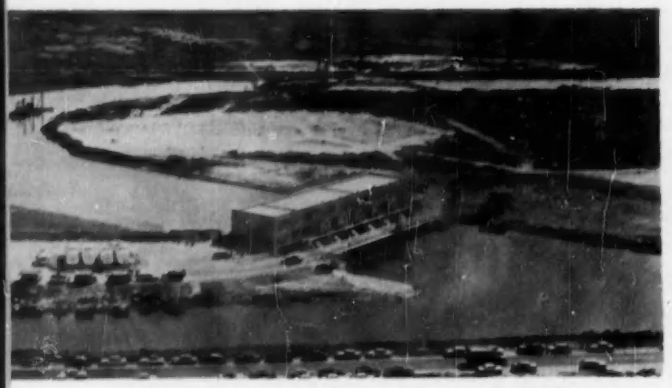
Inadequacy of our roads is an important factor in our industry because road construction is essentially a diesel job. We will probably get some sort of road-building program out of Congress this year but even without this stimulus, it's a big business right now.[6] Contractors have spent over 3-billion dollars in the last decade for new construction equipment. The yearly parts and maintenance bill alone is now over 1-billion dollars. Since this heavy-duty work is a diesel job, it is bound to affect our industry.

Getting into other fields of domestic legislation, increased emphasis on soil and water conservation,[7] flood control, stream pollution, improvement of navigable waters (the St. Lawrence Seaway is one example) all influence the diesel industry. The "Civil Works" function of the Corps of Engineers is well known in many parts of the country and has been publicized by the recent floods. All of their functions and projects are approved by law and either performed by government-owned equipment[8] or that of hired contractors. Since the bulk of the equipment used is diesel-powered, the extent of the civil works program will influence our industry. And this is only one of many branches of the government with programs in which diesels are used.

Legislation affecting transportation is extremely important to our industry. For instance, the Fallon bill that was defeated shortly before Congress adjourned last year would have boosted the trucker's federal tax on diesel fuels from 2 to 6 cents. Their tax on rubber for their tires would be multiplied by ten, tax on recaps three times the present tax on new tires. The effect on the economics of trucking are obvious and, of course, this will affect those supplying diesels to vehicle operators.

Superimposed on federal legislation, various states have boosted taxes on diesel fuels, licensing fees, etc. Restrictions on weights and lengths of vehicles have been made. Restrictive ordinances have been passed concerning smoking, exhaust noise levels,[9] etc. While these have affected the economics of operating diesel vehicles, they have also been a strong incentive for design improvements of both engines and vehicles.

We could go on at great length. For example, watch the changes in our National Transportation Policy that might occur as a result of the Weeks Report to the



Florida protects against flood and has reclaimed 1100 sq miles with help of pump stations like F-M-powered one shown above.

Engineer Corp' mat-sinking plant, repowered with diesels, lays 25% more bank-protecting mat at greatly reduced cost.

President. This report advocates sweeping changes in ICC regulations aimed at relieving railroads of some current regulations. It's a hot controversy and unless carefully worked out, could upset the transportational applecart. And watch the matter of tariffs on certain oil imports.

Fuel Affects Our Industry

The petroleum industry has affected our industry both as a user and a supplier. The latter, of course, is more important. Petroleum technology, competition for its products, industry economics and its distribution patterns are major influencing factors.

Modern magic can give you any fuel you want—if you pay for it. One of the diesel's economic attractions has been its ability to digest something less than "ideal"[10] fuels. In the distillate range we run smack into rough competition for these products for use in house heating, etc. Consequently, prices have gone up. The result in many fields of diesel application has been a search for "economy" fuels or the heavier cuts right down to the residual fuels.

Since we are only one industry competing for a part of the crude barrel, we must pay for specification diesel fuels or shop for useable fuels at a price that we want to pay. Available fuels will vary with refineries, seasonal requirements for other products, and normal patterns of distribution and storage. All of these factors have stimulated our industry to produce engines that can live with a wide range of fuels.

Fitting our industry's economic needs into that of the petroleum industry has resulted in plants burning various intermediate gravity fuels, residual fuels[11] and even crudes when it is economic.[12] If you consider the natural gas industry as being part of the petroleum industry, the spreading availability of relatively low-cost gas has produced our dual-fuel engines and high-compression gas engines.

The petroleum industry has worked hand in hand with ours to solve problems and keep costs down. A major contribution is their line of modern lubricants. Without these improved lube oils, satisfactory service life of some high-output engines would be impossible. And these oils are also instrumental in reducing the harmful effects of some lower-grade fuels.[13]

Users are King

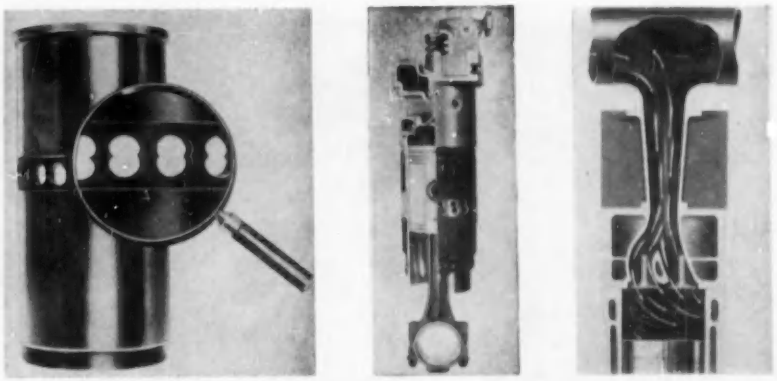
An important influence on our industry is exerted by the thinking of its vast and growing number of users. Some years back, users took pretty much what they could get and the economics of the day—cheap fuels, low labor costs—made it a cinch to make money with their diesels. Today things are different.

Competition for different fuels is a great price leveler and today the price spread is pretty narrow. You know what labor costs. The result is less margin for error. Engines must be fully adaptable to the service intended so as to give the best performance. Total costs of ownership and operation must show a balance in favor of the diesel.

The bulk of diesel engines sold today is in the below-300 hp range. Since the principle competition here is the gasoline engine, it is inevitable that the user's mental conditioning is affected by what goes on in the automotive industry. Concepts of what constitutes satisfactory service, parts availability and pricing policies, as well as availability of service information are compared with automotive practices.

In short, the high-speed diesel engine industry is following the general pattern of the automotive industry. There are some hold-outs among the engine builders who will argue to the contrary but we honestly think that it is more a matter of policy than conviction. In the meanwhile, they are leaving themselves wide open.

Today, the diesel parts replacement field is ten times bigger than the original equipment market. Several independent parts manufacturers are currently supplying replacement parts for various engines. They cost somewhat less and/or have some special features appealing to the users. They must do a satisfactory job in most cases because we'll show you shop after shop (independents)[14] that use them and apparently keep their cus-



Why modern engines breathe better. Porting area of Detroit Diesel's liner at right was increased 30% and ports angled for better flow.

Center—Harnischfeger altered porting and redesigned whole combustion chamber for better flow. Right—Worthington, designing their W9 engine for over 200 bmep, developed a "jet-swirl" intake.

tomers happy. This, after all, is a basic criterion.

Plus those independents already in the field there are a number of others eyeing this growing market. If some engine builders don't become more realistic, serious inroads will be made in their parts business. And it's hard to get back; ask the automotive boys.

So much for the causes for change; how has our industry met the challenge?

Target for Customer Satisfaction

The sum total of influencing factors determines the direction of research and development. Each engine builder must evaluate the factors pertaining to the type and horsepower range of his engines and move in the direction of giving the customer what he wants. Customers' requirements are always simple (to him) and can be listed in a general way as follows:

1. He wants more power in a smaller, lighter package.
2. He wants it at a price such that when all the cost sheets are in, he gets his power for less than he would with competitive forms of power.
3. Performance must be equal to or better than that of competitive prime movers.
4. Reliability and long service life are expected and he knows the influence of these on Items 2.
5. He wants service and service information in accordance with *his* concepts as developed through comparison with other forms of power.

More Power in a Smaller, Lighter Package

If you compare engine specifications over the past few years, you'll see a steady climb in horsepower for each engine model.[15] Horsepower can be increased in three ways—more cylinder displacement, higher cylinder pressures and higher rpm. But more displacement generally means a bigger engine and this goes against the "smaller, lighter package" concept. So most recent development has been aimed at higher pressures and rpm.

When we speak of higher cylinder pressures, the tendency is to think immediately of supercharging, either by mechanical blowers or turbochargers. While these are important and will be discussed, they are by no means the whole story. Another look at the engine specifications will show that normally-aspirated engines show a horsepower increase that is higher proportionately than is explained by increased rpm. The answer lies in improved design of the combustion chamber and associated systems.

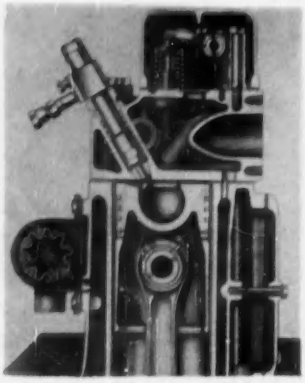
For one thing, today's engines breathe better. Intake and exhaust manifolds are designed in accordance with modern knowledge of the dynamics of gas flow.[16] [17] [18] Intake and exhaust passages are streamlined for better flow and in 2-cycle engines, porting has been opened up and made more effective. The result is that volumetric efficiency is better and the increased air permits more fuel to be burned to get higher cylinder pressures.

Combustion chambers have been improved and injection characteristics tailored to get more complete combustion. This means a higher energy level with the same fuel or the same level with less fuel,[19] depending on what suits your purpose best. It also means less deposits and a cleaner engine with a higher smoke limit.

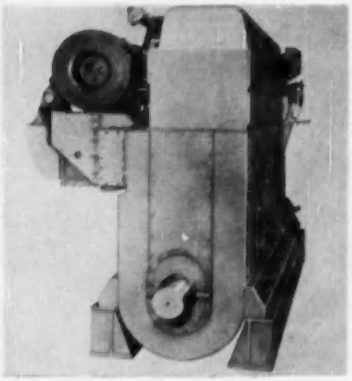
Combustion reactions are coming in for more study. There is now some question as to whether the accepted practice of injecting fuel in a finely divided mist is correct. The antithesis of this is the M.A.N M-System[20] engine that smears the fuel on the wall of the combustion chamber (their's is in the piston) and "peels" it off as it becomes properly conditioned to enter the combustion process. A shrouded valve gives the required air swirl.

Results are so impressive that several American engine builders are investigating. A range of fuel from low-cetane diesel fuel to 80-octane gasoline can be burned with surprisingly little difference in performance, the characteristic "diesel knock" is eliminated, fuel economy good, and lugging ability excellent.

Some American engineers subscribe to the principles involved. The closest application in American engines is found in the Caterpillar precombustion system and in commenting on it in several technical papers, Mr. C. G. A. Rosen has similarly described the principle of fuel impingement on the precombustion chamber wall to be



Performance of M.A.N.'s M-System engine challenges long-held concepts.



Kahlenberg's 2-cycle diesel with Napier unit has fully-sustained turbo operation.

Schweitzer-Cummin' small turbocharger bolts to exhaust manifold.

later "peeled" of as it is prepared for combustion.

These principles that improve normally-aspirated engines apply perhaps to a greater extent in supercharged engines. For many years after Dr. Buchi's turbocharging system was first applied, the exhaust-driven turbocharger seemed to be the exclusive property of the 4-cycle large-engine field. Performance on small engines, particularly in vehicular service, was disappointing. Mechanical blowers were better for these engines and, of course, for 2-cycle engines.

What a change! We have not only Dr. Buchi's pulse system but constant-pressure, high-pressure systems. Overall improvement in turbocharger efficiency has been such that their response to engine speed changes is fast enough to suit even vehicular applications.[21, 22] And as for 2-cycle engines—it is now possible to start and run with completely self-sustaining turbocharger operation.[23, 24, 25] This is true for both natural gas engines and diesels.

In the last decade we have seen bmep's climb from a modest 130 psi to about 200 psi in commercially-offered engines and much higher on the test floors.[26, 27] In 2-cycle engines, bmep's have gone from around 70 psi to over 100 psi. You now see turbocharged engines on trucks, buses and tractors.[28, 29, 30] It takes no crystal ball to foresee that turbocharging is taking over. And the next step is engine compounding.

Increasing the rpm is also a popular way to get more horsepower. Some users have dragged their heels in accepting higher rpm's and will drive down in their automobiles with 4200 rpm engines to tell you so. The fact is that improvements in metallurgy, design of the components, and modern lubricants make higher speeds a logical step. Instead of putting yardsticks on how fast the shaft should turn, or even piston speeds, it might be better to define "high" speeds as being in excess of those for which the engine was designed. It would save a lot of confusion.

So we see that both higher pressures and rpm's produce more power and so so with the same basic "package". The trend is so marked that in the big-engine field we see modern engines replacing older units and fitting in the same space and on the same foundations, yet providing double the horsepower. No expensive additional building construction or foundation costs. In the small-engine field, some builders are shooting at (and coming pretty close to) making diesels that match equivalent gasoline engines in horsepower, size and weight. They'll do it too.

Economics of Ownership

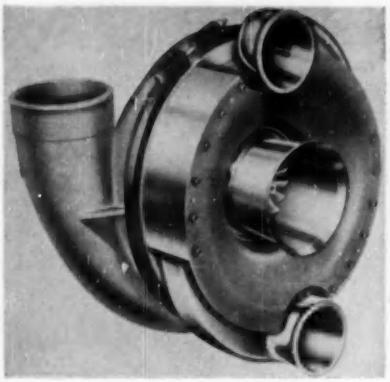
Now when we come to the economics of diesel ownership and operation we must consider a number of factors including those mentioned in Items 4 and 5. First cost is a big factor. It applies in all sizes and types of diesels and is the first competitive hurdle to be faced. Besides meeting the price of competitive engines, you have to compete with other forms of power. Any premium price is the nut to crack. You may be able to amortize it quickly but sometimes this is a hard idea to sell.

In the large-engine field several tacks have been taken. Boosting power in the ways mentioned has helped a great deal. Because of general cost increases, Model XYZ may cost a great deal more than it did ten years ago. But you buy power, not a model number, and since all engines boast substantial horsepower increases, the cost-per-horsepower rise has been fairly nominal.

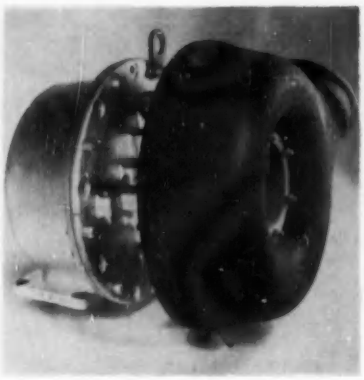
Recently, one engineer commented that cost reduction was approached in his company via the time study and shop efficiency route. The shop was pretty efficient to start so the net savings were well below 5%. But with a modest development cost, horsepower of their line of engines was raised an average of over 20%. Figure out the effect on their next bids.

This principle applies to small engines too. However, they have a somewhat different problem. Production volume is low when compared to that of their major competitor—the automotive-type gasoline engine. Also, the cost of fuel injection is not proportional to its size and so this vital component represents a large chunk of the small-engine dollar.

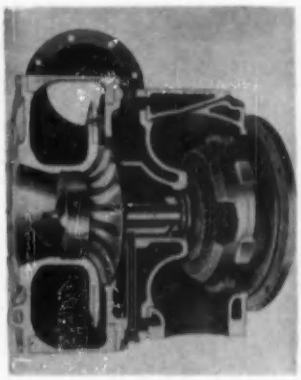
There have been moves toward helping the "volume"



Miehle-Dexter's (De Laval license) turbocharger, built for small engines.



AiResearch turbo made its debut on Caterpillar's D-9 tractor engine.



Cutaway of Elliott's small unit of type first used on Cummins racer.

angle by using the same engine blocks for heavy-duty gasoline engines and diesels. Of course, the principal application of this idea is by those engine builders building both types. In many cases some parts are interchangeable too. This is an interesting commentary on how far diesel engine builders have gone in matching the horsepower, size and weight of competitive gasoline engines.

Important changes have occurred in the field of fuel injection.[21, 22, 23] There is a two-pronged incentive for this. First, cost reduction to help bring initial engine cost into better alignment and, secondly, reduction in the cost of maintenance and repairs. The principle used was design simplification and reduction in the number of complex, lap-fitted parts.

This break-out from one of the diesel's "holy of holies" is important and we'll see more changes. The best part is that the engines don't seem to know the difference. Small, compact distributor-type systems are becoming practically standard in the small-engine field. Also, Cummins has their PT (pressure-time) system.

Nozzle types are changing too. We see many small-engine builders and at least one large-engine builder swinging from the old standby—the hydraulically-operated, differential-type nozzle—to simple units opening in the direction of fuel flow. Some are thrown-away units of the capsule type while the others permit some simple maintenance or part replacement. In any case they are less expensive and when repairable, are easier to fix.

All of the changes mentioned so far contribute beneficially to another cost item—fuel costs. Improved combustion characteristics and higher mechanical efficiencies (as more power is produced for the same frictional loss) are bettering thermal efficiencies and we get more power for our fuel dollar. The increasing ability to burn a wide range of fuels permits users to take advantage of favorable local fuel cost situations. So diesels have the edge on thermal efficiency and usually a fuel price advantage.

Improving Performance

With better combustion, finer materials, and improved knowledge in the field of vibration dynamics, we now have better-running, smoother engines. Torque curves can be tailored to suit the application. Engines are more flexible and thus are suited to many new applications.

Today's engine is less sensitive to environment than yesterday's engine. Thanks to turbocharging, engines retain ratings to higher altitudes. With aftercooling and/or precooling in conjunction with the turbocharger, high ambient temperatures are no longer reasons for derating the engine. At the same time, mean cycle temperatures are reduced and in natural gas engines, possibility of detonation avoided.

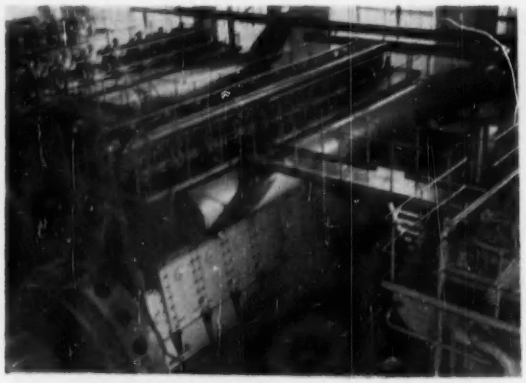
Good lugging ability was and continues to be one of the diesel's virtues. It show up in the ability of diesel tractor-trailer rigs to pull hills faster than their gasoline engine-powered competitors. You'll see it when a bulldozer takes a deep bite in heavy material or when a shovel crowds a dense bank.

We have touched on fuel consumption before. Not only are specific rates improving but we are burning a wider range of fuels. Great gains have been made in the part-load fuel consumption of natural gas engines by automatically throttling intake air in accordance with load. Better fuel rates and performance are being obtained in the high-speed engines by automatic injection timing features in some of the latest injection systems.

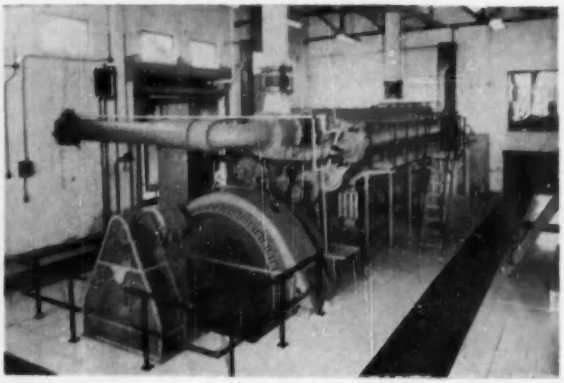
Long Useful Service is Standard

Reliability and long service life of diesels has always been recognized. This reputation is still unimpaired despite the higher outputs and rotative speeds. For example, there is growing evidence that service life may benefit from turbocharging. The cooling effect on parts during blow-through when valve overlap occurs, scavenging of the residual gases, and the effect on charge temperature (hence mean cycle temperature) of pre- and/or aftercooling all tend to keep parts cooler than in non-turbocharged engines.

You hear a good deal of nostalgic talk about the "good



Four Nordbergs totaling 15,850 hp take space of four older units totaling 4600 hp in Rockville Center, N. Y., Plant.



Brady, Texas, Municipal Plant picked a vee-type turbocharged Cooper-Bessemer to pack 3550 hp in a "smaller-engine" space.

old engines" of yesteryear. True, some of them did very well but there is a sentimental tendency to forget their more "ornery" moments. We have yet to hear someone yearn for a return to the steeple compressors of air injection days. Fact of the matter is that you couldn't compete today with yesterday's engines. Check the records of modern power plant operation and you'll see that the older engines are used only in an emergency or for peaking.

Let's remember one thing; time is a poor basis for comparing performance. Taking a modern engine and an older unit of the same displacement, today's engine will do up to twice the work in the same period of time. And do it on proportionately less fuel. Another thing is that in many applications, the early principle of building diesels to last a lifetime is no longer valid.

For one thing, it is silly to build an engine that will far outlast the equipment that it powers. For example, a truck may be amortized over a five year period. Is it reasonable to design 20 years of life into the engine? Also, design improvement come so thick and fast that a certain obsolescence factor must be figured. Times change and these are competitive times. Therefore, today's engines are often only required to do a better job than their competitors *only for a reasonably longer period.*

While this is a necessary and practical philosophy, service life is still increasing daily. Better designs, superior materials, finer accessory and protective equipment, better drives (fluid couplings, torque converters, etc.), and better understanding of operation and maintenance are helping today's engines to rack up superior operating records.

Liners of wear resistant-material; chrome-plated bores; aluminum pistons with Ni-Resist ring inserts; better piston rings, some with chrome faces; valves and inserts of heat and wear-resisting materials are some reasons for better power assembly life. Copper-lead and aluminum precision-type bearings will handle today's bearing loads. Modern oils lubricate, clean, and carry away the heat.

Better air and lube oil filters keep the engines clean and eliminate the bulk of harmful particles. Even the cooling water is treated with readily-available materials to reduce rusting, scaling and galvanic action. These are some of the reasons why today's engines do such a good job for such a long time.

Service and Service Information

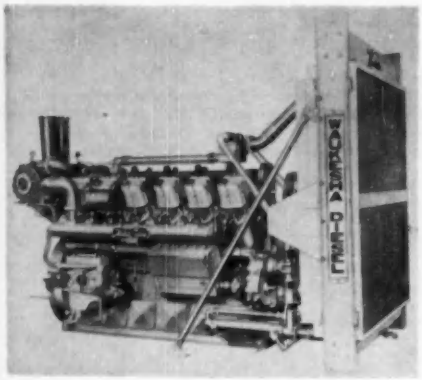
We now come to the controversial subject of parts availability and service information. We have always contended that a good running engine, making money for its owner, was the best possible advertisement for the engine builder and the diesel engine industry as a whole. When there were relatively few engines in service, engine builders in general could keep pretty good control of parts and service.

But today, engines are practically a shelf item and in many cases, the builder can't keep track of his engines or their application. Diesels have a way of getting into vital operations and are often integrated with a lot of other equipment. Take on a road job. The failure of a diesel-powered shovel can tie up several dump trucks, dozers, graders, rollers, crushers, etc. Downtime is fantastically expensive.

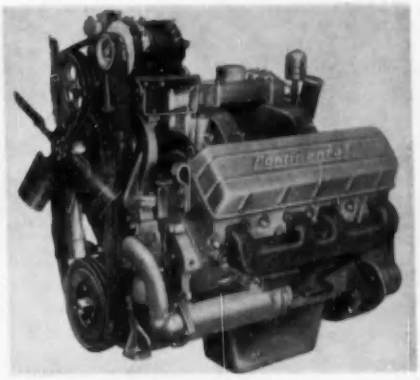
The owner wants service—and fast! He may have switched from gasoline to diesel power but his thinking is influenced by his gasoline engine experience. He could get parts locally, if he was a fleet operator he got a break in the pricing structure, and he could get all the service information necessary to fix the rig on the spot.

Some years back—and even in some cases today—he'd be in tough shape. One of the most profound changes in our industry has been the erosion of the dam that held back the flood of needed service information. As little as five years ago we were refused permission to publish simple "How to . . ." articles. Now, many engine builders will give us just about everything and the few remaining are loosening up gradually.

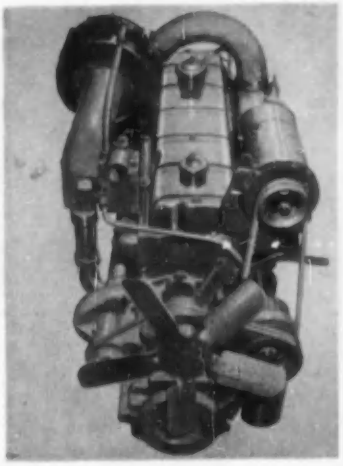
There is also a growing realization that for successful expansion of the diesel market, every agency for parts distribution and type of service facility must be used. No longer can dealer-distributor setups plus fleet operator shops handle all the diesel repair work that must be done.



Waukesha went to turbocharged vee design to get 1100 hp at 1200 rpm in a compact industrial unit.



Continental got high power/weight ratio by chunky vee design. Cummins JT-6 got it by turbocharging.



Other facilities must plug the gaps between service points to give the user the kind of service that he is demanding.

Discount structures applying to part sales are undergoing modification. The independent shop and the fleet owner wants his share. If he can't get it on factory parts, he'll buy independent replacements. Nor will he go 50 miles for a factory part when he can get a replacement from a jobber around the corner. In short, users want service and our industry, in general is catching wise.

Conclusion

Concluding this highlighting of cause and effect as they pertain to our changing industry, we might also comment on our changing industry magazine. We have conscienciously tried to follow the trends, interpret them, and render service of the type we thought most valuable. From the removed and objective editorial perch, we have even tried to influence trends to the industry's best advantage.

We like to think, for example, that we were helpful in getting the release of service information; we have preached that particular gospel for years. Our contacts tell us that users want it and paraphrasing a popular comment, "What's good for the user is good for the industry".

Our bibliography gives some indication of how we have kept tabs on industry changes in the past. And since the New Year is the time for high resolutions, we'll pledge to keep abreast of future industry changes, endeavoring to render service of a caliber doing credit to the excellence of our modern diesel engines.

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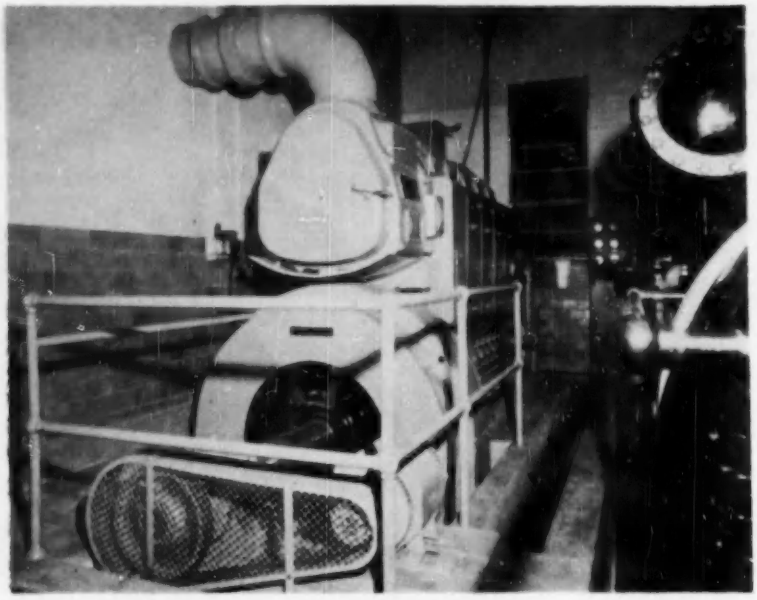
2.	Caterpillar Meets a Tough Requirement	Jan	1955	P.46
3.	Our Industry and Production Allocation Planning	May	1955	P.32
4.	Rail-Mounted Standby Power	Mar	1953	P.60
5.	Electro-Mobile Power	Nov	1954	P.30
6.	The Turner Turnpike	Jul	1953	P.45
7.	Resource Development with Diesels	May	1955	P.38
8.	Faster, Lower Cost Bank Stabilization	May	1955	P.35
9.	Vehicle Exhaust Noise—An Industry Problem	May	1954	P.34
10.	Using Economy Fuels	May	1955	P.42
11.	Decatur Plans for Economy	Dec.	1954	P.26
12.	Tapline Depends on Diesels	Apr	1951	P.70
13.	New Improved Oils Combat Effects of High Sulfur Fuels	Jan	1949	P.48
14.	Talking Shops—A Continuing Series			
15.	Engines Specifications	April		
16.	GM "71" Cylinder Assembly Has New Look	Oct	1954	P.58
17.	More Power for P & H Engines	Apr	1954	P.81
18.	Worthington's W-9	Dec	1955	P.51
19.	Mack's Thermodyne Diesel	Aug	1953	P.50
20.	MAN's Whisper Engine	Nov	1955	P.38
21.	Cummins JT-6 Turbodiesel	Jul	1955	P.90
22.	Waukesha Turbochargers	Jan	1953	P.40
23.	A Self-Sustained Turbocharged 2-Cycle Diesel	Dec	1955	P.26
24.	Worthington's Fully-Turbocharged 2-Cycle Gas Engine	Jan	1954	P.46
25.	Turbocharging the 2-Cycle Gas Engines	Apr	1954	P.70
26.	Supairthermal Vee For Gas Pipelines	Apr	1955	P.50
27.	Worthington's W-9	Dec	1955	P.51
28.	Supercharging to Improve performance	Feb	1954	P.42
29.	Turbochargers Enter New Fields	Jun	1955	P.32
30.	Schwitzer-Cummins' Turbocharger	Sep	1954	P.45
31.	Bosch's New Fuel Injection System	Feb	1955	P.34
32.	Cummins' Simplified Fuel Injection System	Aug	1954	P.42
33.	RoosaMaster Fuel Injection Pump	Nov	1952	P.36



New 8-cyl, O-P engine generated more than 16% of the Woodbine plant's 1954 total capacity in just 10 weeks of operation. Fuel consumption at ¾ load is 14.12 kwh/gal.

Electricity and Extras at Woodbine

Producing power is the main job for the personnel of Woodbine, Iowa's municipal utility. Next on the list however is service you don't normally get.

ANY housewife of Woodbine, Iowa, who finds she has a frayed lamp cord or a stalled washing machine to cope with, generally looks out of the window to see if the municipal power plant's service truck is coming down the street. Whether it be the plant superintendent, the lineman, or one of the plant's three operators, Mrs. Housewife can count on him to stop in and put things to rights again before continuing on his way. Lest it be said that that's no way to run a power plant, the office manager at the plant, a lady, is perfectly capable of operating the plant if the regular operator is busy with a maintenance job or is out in town generating good will.

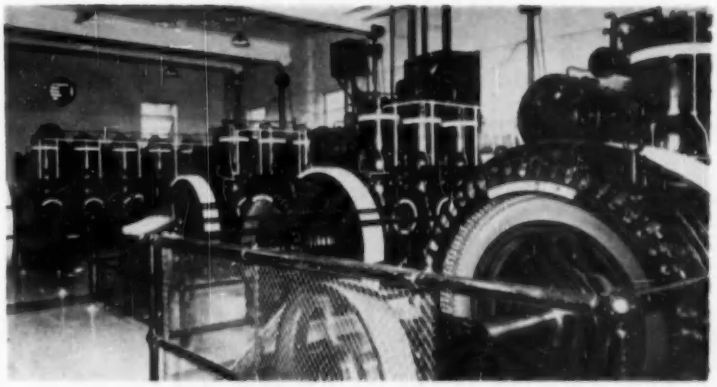
The utility staff, of course, has a full-time job operating and maintaining four Fairbanks-Morse Model 32E14 straight oil diesels and a new 8-cylinder opposed-piston unit that was installed in October, 1954, but it has made a habit of lending a helping hand to the people of Woodbine and the community as a whole since the plant started in 1941. At this plant, the concept of service starts with the primary task of providing a dependable supply of electricity at moderate cost, then extends to helping the customers get full satisfaction with the power they buy.

In addition to the power plant, the staff operates the water system, sewers and public parks of Woodbine and when Christmas approaches each year it turns out in force to string decorative lights over the city's streets. The plant supplies current for the lights during the holidays without charge and, when the holidays are over, the staff takes the lights down again in the same spirit of cooperation.

Throughout the year, the plant lights the city's athletic field when there are night games on the schedule and sends a man to handle the switches for only $10 a night. It lights the city's skating rink and supplies free extra current for religious or civic meetings in the community.

While the power station people are exceptionally generous with their time and effort in the community, the power plant, their main concern, is operated with notable efficiency. The plant was started in 1941 when the community decided that a municipal power station would provide more dependable service at lower rates. The plant was built on the city's main thoroughfare and equipped originally with three F-M Model 32E14 diesels, one unit rated at 300 hp and two at 225 hp each, developing rated power at 300 rpm.

At the time, the city thought this equipment was adequate for any load in the future. However, more and more residences were wired, more electrical appliances utilized and the number of industrial users climbed to an unexpected high. Consequently, the city installed an addi-



F-M Model 32E14, 300-hp unit in foreground and two 225-hp Model 32E14 units in center served plant since 1941. Model 32, 6-cyl, 450-hp engine in rear was installed in 1949 and carried 74% of the load until 1954.

tional 450 hp F-M Model 32 in September 1949, to supply additional demands.

In spite of Woodbine's stable population—holding at 1300 over the last decade—power demand continued to increase. By 1953, the demand was more than 300% per capita above 1941 levels and still going up. A survey showed that the largest unit in the plant operated 6408 hr or 74% of the time. A further investigation showed that only during 26% of the time could combinations of the smaller three units handle the load. These findings induced the utility's Board of Trustees to approve the purchase of a fifth F-M engine, this time an 8-cyl O-P unit, and it was installed in October, 1954.

The new O-P, rated 1120 hp at 600 rpm, brought plant capacity up to 2320 hp making it possible for the plant to handle peaks of 1568 kw. In an 8 hr test run under a 350 kw load, less than half engine capacity, the OP produced 13.08 kwh per fuel gallon and bettered it with 14.12 kw under a ¾ load. Operating for only 10 weeks in 1954, the O-P produced 16% of the the plant's total kw for the year.

The surprising increase in power demand is due in a large part to the Woodbine plant's dependability as an energy provider and to its moderate rate schedule. For example, in 1941 there were 11 electric water heaters in the community, operating during off-peak hours. Because the power supply was so dependable, the number grew by 1953 to 305 heaters that are permitted to operate at any time in the 24-hr period. The plant's management says modestly that luck had something to do with its reputation for dependability—it hasn't had a line interruption since a storm toppled some lines in 1945—but it's a matter of record that the plant has never had an engine failure.

Since natural gas for fuel is unavailable, Woodbine operates exclusively on oil. It uses a 50-50 mixture of Caesar crude oil of 22 to 24 gravity, costing .1033 per gal delivered, and a heavy cycle gas oil of 20 gravity, at .0831 per gal delivered. Heavier fuel can be used if necessary.

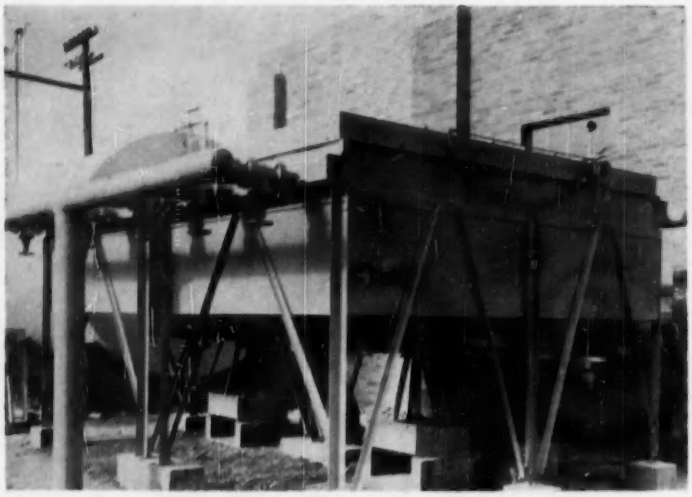
Fuel is supplied to the plant by tank cars that unload into a 16,000-gal unloading tank near the tracks. From this tank, the oil is pumped to a 21,000-gal tank near the plant from whence it flows to the engines' day tanks located in a closed pit outside the station building. Fuel passes through a meter, heater and filter before entry into the engines.

Fuel meters are checked every year for accuracy. The fuel heater uses radiator water and the plant keeps the fuel at an even temperature to promote better filtration and atomizing. As a result, the fuel is more completely burned and there is less waste. When the plant installed a fuel filter with a permanent filtering element between the 21,000-gal tank and the day tanks, fuel pump maintenance dropped 42%.

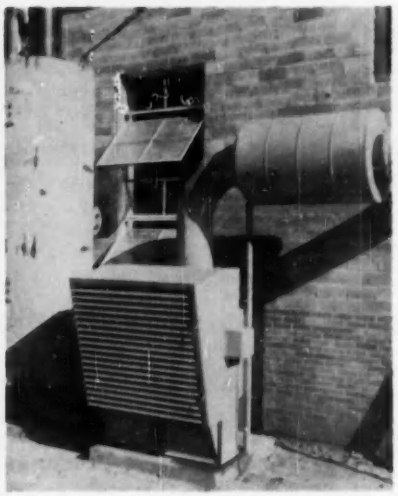
The engines are checked every weekend. Maintenance men clean the fuel nozzles and other working parts as a routine efficiency measure. Pistons are pulled once a year and a complete record kept on wear, maintenance, compression and the performance of each engine.

The O-P uses a detergent-type lube oil. A transfer pump supplies lube as required from a 600-gal storage tank through a full-flow filter to the engines. The same pump operates continuously to take lube from the crankcase, put it through a 2-cartridge cellulose pack filter and back to the engine again. The main oil circuit includes an engine-driven pump, automatic thermostatic valves and a lube cooler. There is a motor-driven auxiliary lube pump to bring pressure up before starting the engine. Lube for the four Model 32s goes down to a dirty oil tank for cleaning and is batched through a purifier.

Jacket water is circulated through the OP and a heat exchanger by a centrifugal pump mounted on the engine. Automatic thermostatic valves maintain prescribed temperature for the jacket water. The Model 32s are all on a common jacket water header supplied by two centrifugal pumps. City water is used when make-up is needed. A softener for the make-up water for both the O-P and the Model 32 engines' cooling systems softens water 3500 to 7000 gpd. Between August and October, 1954, only 55 gal of make-up water were added to the system.



Dual radiator brought down power consumed by plant from 15,000/16,000 kwh per month to 5000 kwh per month. Automatic controls turn on first fan at low speed, then second fan at low speed, then first at high speed, then second at high speed.



Silencer at left dampens exhaust noise. Silencer at right reduces intake air noise. Self-cleaning type air filter is in center.

Introduction of a dual radiator with automatic control feature has effected a notable reduction in plant use of power. The plant used to run seven motors on the cooling system and consumed 15,000 to 16,000 kwh per month. The dual radiator runs about 15 minutes each hour, and has reduced current consumption to 5000 kwh per month. Controls start one of the two radiator fans on low speed, then the other on low speed, then one on high and then the other on high speed.

Intake air is cleaned by a self-cleaning revolving filter that can be set for one revolution in 12 or 24 hours. Air is then drawn through an intake silencer. Exhaust noise is dampened by a vertical silencer outside the building. Plant operation is very quiet, creating no noise problem at its location on the city's main business thoroughfare.

The O-P has a separate gauge and alarm panel. Audible and visible alarms signal personnel whenever there is a drop in fuel, lube or water pressures or a rise in temperatures. There is also a horn and red light alarm on the high day tank level.

Summary

Being both an efficient producer of power and a remarkably good neighbor in the community, the Woodbine power plant is a natural financial success. Its original bond issue of $115,000 was paid off in just 11½ years, four years ahead of schedule, and the product it manufactures—electricity—is the only thing the people of the community can buy today that is lower in price than at any time in the last decade.

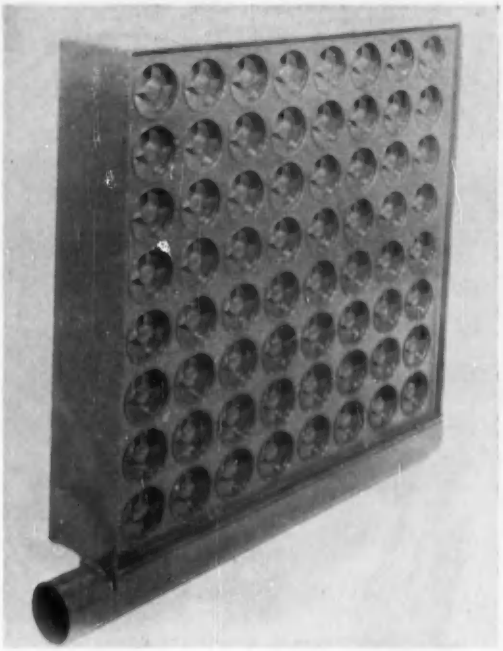
A more tangible sign of its financial success was a new whiteway which the utility purchased and installed in the community's business district at a cost of $10,000. The whiteway replaced 28 old street lamps with new electroliers using 300-watt lamps, and the utility maintains the new electroliers at no extra cost to the taxpayers.

The plant has given an estimated $33,000 to the city to date in free services and lighting equipment. But that is only a minor part of the services which Plant Superintendent Otis M. Dean and his staff have rendered to the customer-owners of the Woodbine plant.

PRINCIPAL EQUIPMENT

Engine	Fairbanks, Morse & Company
Alternator	Fairbanks, Morse & Company
Governor	Woodward Governor Co.
Fuel System	
Filters	Wm. W. Nugent & Co., Inc. Sentinel
Oil	Diesel Service Co.
Meter	Buffalo
Heater	Diesel Service Co.
Lube Oil System	
Oil	Sinclair Oil Co.
Filter	Air-Maze Corp.
Purifier	Hilco Hyflow (Hiltex). The Hilliard Co.
Cooler	Ross Heater Div. Kewanee-Ross Corp.
Transfer Pump	John S. Barnes Corp.
Jacket Water System	
Pumps	Fairbanks, Morse & Company Weinman
Heat exchanger	Ross Heater Div. Kewanee-Ross Corp.
Softener	Elgin
Radiator (Dual)	Young Radiator Co.
Air Cleaner	Air-Maze Corp.
Intake silencer	Air-Maze Corp.
Exhaust silencer	Maxim Silencer Co.
Thermostatic valves	Amot
Gauges	Joseph P. Marsh
Pyrometer	Alnor-Illinois Testing Labs., Inc.
Switchboard	General Electric
Oil Circuit breakers	General Electric
Voltage regulators	Allis-Chalmers
Tank cars	Illinois Central Railroad

Self-Cleaning Air Filter



Efforts to reduce engine downtime and maintenance costs are given a boost by the use of self-cleaning air filters which need a minimum of attention and servicing.

MORE and more emphasis is being placed on reducing engine downtime and maintenance costs. Development of a self-cleaning air filter fits into this pattern. This new unit, the Rotonamic filter made by the Farr Co., has been applied mainly to locomotive diesels. Laboratory tests indicate that it is about 98% efficient on particles in the 5 to 15 micron range.

The Rotonamic applies the principle of dual cyclonic action. This action separates solid particles from the air by centrifugal force in a two way high-velocity air stream. The centrifuged dust particles perform a continuous scouring action on the internal parts of the filter. This self-cleaning operation eliminates the need for servicing the air cleaner.

A 20-in x 20-in x 4-1/8-in Rotonamic panel consists of 64 cyclonic-type, 4-bladed separator units arranged in parallel rows. Each panel can handle from 1000 to 2000 cfm. Where more than 2000 cfm is required, a number of panels can be arranged in banks.

Incoming unfiltered air is drawn through the deflecting vanes in the panel by a blower. As the air passes through the vanes it enters 64 separate intake tubes, one for each of the vanes. The vanes give the air a high velocity rotary motion. It is this rotary motion that causes dust particles to be thrown outward in the intake tube. These dirt particles are then carried by bleed-off air through cleaner bleed-off lines. In some installations these lines are connected to engine exhaust snubbers. In other installations they may be connected to the suction side of a small blower.

Velocity of the engine exhaust gases past the bleed-off line opening, when in the snubber, creates a lower-than-atmospheric-pressure at the outlet of the bleed line in the snubber. This pressure differential causes about 10% of the air flowing into the air cleaner to go to the snubber through the bleed-off lines. Air moving through the bleed-off lines picks up particles thrown out by the whirling action in the filter.

When bleed-lines are connected to a small blower instead of a snubber, it is the blower which creates a pressure lower than atmospheric. This blower delivers the dirt and bleed-off air to the atmosphere or into a bag collector. An exhaust stack aspirator or eductor can be used in place of the bleed-off blower.

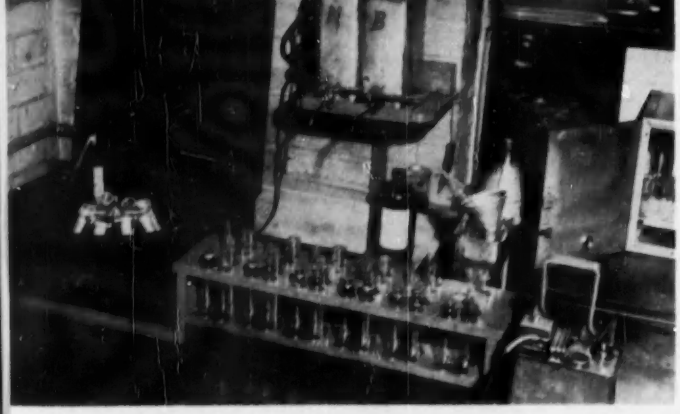
Thus the dirt is exhausted through the snubber, directly into the atmosphere, or into a bag collector after being removed from the main air stream. The main air flow, still whirling, reverses direction and travels toward the inlet around the outside of the discharge tube. This provides the second cyclonic action. Cleaned air then flows through the discharge tube and into the engine air intake manifold.

The basic action then is not only to clean air but also to remove dirt. Therefore, the filter is essentially maintenance free. However, it should be inspected periodically to be sure that screwed clamps and clamping devices are tight. Also that bleed-line flexible tubing and connections are not broken or loose.

The filter face should be kept free of rags, leaves and papers to assure a full flow of air. To remove the surface accumulation of dirt, set the engine at half speed and direct a stream of low pressure air across the face of the filter. *Don't use high pressure air*, it may force dirt into the intake air systems.

At annual maintenance periods the panels should be removed and blown clean with compressed air from both front and back. Bleed-off connection should also be blown clean. Inspection of flexible tubing, clamps, seals and fastenings should be made at this time too.

In the past the Rotonamic has been mainly used for locomotive diesels. But it is available and tests have proven it to be applicable for many other services.



Purchased and shop-built oil testing equipment is compact. Centrifuge at left is used for precipitation and water and sediment tests.

B & W Lines Tests Oil

Direct and indirect cost savings have justified including a lube oil testing procedure in day-to-day maintenance. Another in a series of articles on lube oil and filter element change practices and procedures.

B & W Lines saves upward of a hundred dollars a month in lube oil and filter element costs. How? By a system of planned lube oil control. And this saving in direct costs is made in a fleet of 50 buses.

When talking to Gus Heiber, vice-president of maintenance, B & W Lines, Framingham, Mass., he'll tell you these costs that show up on the balance sheet are only part of the savings; some of the conditions averted could cost them a lot more. Since they don't happen, they don't show up in the cost sheet.

Back in 1949, Mr. Heiber was convinced that if he could find the answers to two questions, maintenance costs could be cut. These questions were:

1. When should filter elements be changed?
2. When should lube oil be drained?

Early filter changes and crankcase drainage are wasteful; too long an interval harms the engines. Both conditions are eventually reflected in maintenance costs. The problem—as in morality or art—is in drawing that certain line somewhere.

Proof that Mr. Heiber succeeded in getting his answers in the intervening years is evidenced by some figures given here that show the savings made. Proof that the engines are not suffering is seen in the fact that B & W Lines has won the Bus Transportation Maintenance Awards ten times since 1941.

This is a lube oil control story and not a 100% diesel story. Most of the data to be presented is based on experience with gasoline engine-powered buses. B & W Line's swing to diesels started in July, 1954, when they bought four GMC diesel buses. Three more have been in service since July, 1955. The same program that was so successfully used on the mixed fleet of 23 Fords, 12 ACF-Brills and 8 Twin Coaches is being applied to the seven GMC diesels.

One other point must be remembered. Performance results obtained in a program of this kind and some of the criteria that will be mentioned are only valid for the particular type of service and operation involved. Therefore, it is important to understand how these buses are used.

The Fords operate on local and short extra-service exclusively. The GMC diesels and the ACF-Brills operate on a 40-mile run between Boston and Worcester with some local stops. The Twin Coaches handle the 18-mile run between Framingham and Boston. On both of the relatively long-haul runs, the daily average is between 276 and 372 miles.

This sets the stage for a discussion of Mr. Heiber's lube oil control program. Let's see how he went about getting answers to his two questions.

Approach to a Lube Control Program

A student of military tactics will tell you that the success of a campaign is often directly proportional to its simplicity. It's the same with a lube oil control program. You can get so wound up in technicalities, complications, "if's", "and's" and "but's" that everyone gets thoroughly confused. If this happens, you either hire a lubrication engineer or forget the whole thing.

So Gus Heiber figured that anything that he did would have to be simple; something that could be done by someone in the shop after a little training. He scouted around for ways and means to implement his ideas and finally settled on the oil testing equipment built by The Gerin Corporation of Avon, New Jersey.

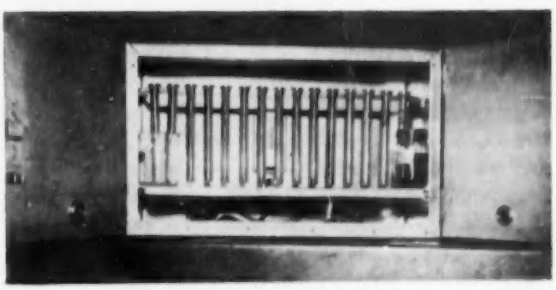
The testing kit is ordinarily portable but preliminary investigation convinced Mr. Heiber that the program would work out as anticipated and so he set aside a portion of the electrical shop as a permanent testing area. In addition to investing in a little equipment, investment was made in a man's time. George Schurzky, an electrician, was selected and he worked along with Mr. Heiber, Gerin and Cities Service Oil Company's representative. B & W Lines uses Cities Service Company's fuel and their C-300 Series lube oils.

After a period of familiarization and experimentation with the simple equipment, development of procedures and cautious inching up of condemning limits, the lube oil control program got into full swing and became a routine portion of the overall maintenance program. Mr. Schurzky devotes as much of his time as is necessary to perform the routine tests. A qualified alternate takes over if he is not there.

The brief rundown on how the program was started illustrates one important point—if you are going into such campaign you have to work at it. You must get help from every possible source, work out every single angle, and be willing to make some investment in time and money.

Valved spouts on naptha and benzine cans are for easier and more accurate proportioning. Geo Schurzky is preparing for precipitation test.

Shop-built jet pump. Two electric pumps supplying the solvent jet, cleans packed residue in tubes. At right, viscosity is tested by falling ball-type tester, permanently set for convience and accuracy.



Thermostatically controlled heating cabinet was built to insure equal temperature of samples and reference oil (right in cabinet).

Running the Tests

Lube oils have a great many characteristics. If you doubt it, look at a typical analysis of the type that a refinery would supply. Fortunately, evaluation of used lube oils in the field is concerned with only a few items that indicate the type and degree of contamination. Their effect on engine operation is pretty well known and if we can find out how much of each is tolerable, we are on our way to knowing when to dump oil and change filters.

Mr. Heiber adopted the Gerin technique. Here, four characteristics are determined: (1) change in oil viscosity; (2) Precipitation Number; (3) Water & Sediment; and Neutralization Number.

Viscosity is very important. We know that new oil of the viscosity recommended for the engine will provide sufficient oil film thickness at the normal temperatures in various parts of the engine. Reduction in viscosity resulting from fuel dilution reduces film thickness and film strengths. At some point these break down and increased wear results.

Research people tell us that use of oils of higher volatility and poor thermal stability show tendencies toward higher engine wear rates. It would appear, then, that oil dilution with the relatively high-volatility, low-flash fuels would play right into the hands of this phenomena and that there is some sort of correlation between wear rates and the degree of reduction in viscosity through fuel dilution.

In any case, reduction in viscosity is measured each time an oil sample is tested. The used oil sample is compared to a new oil sample in a falling ball-type tester and the result is expressed as a percentage of new oil viscosity. New and used oil samples are placed in separate tubes, their temperatures allowed to equalize, and each rod marker is set at "Zero". The release button is pressed and held until one marker falls to "100". Rod movement is stopped releasing the button.

The numerical difference between the two markers is the *percentage difference in viscosity*. If the difference was 15, the used oil would have 85% of new oil viscosity. Note that we are not speaking of *percentage of dilution*. Actually, it is unfortunate that the practice of expressing dilution as a percentage has become widespread. It is an unnecessary and sometimes difficult step to make the conversion and it serves no purpose.

Change in viscosity is what is important. This is the *net* of the contaminants that tend to thicken the oil integrated with the diluents. For example, in natural gas-burning engines where fuel dilution is not a factor, the used oil viscosity might be above the 100% mark.

Mr. Heiber has set the allowable reduction in viscosity at 50%. Others may decide on a different limit on the basis of their particular operation. For example, one governmental service using this procedure limits the drop to 40%.

Precipitation Number is found by a test involving use of a centrifuge, cone-shaped centrifuge tubes and naptha as a solvent. Clean, unoxidized oil is soluable in the naptha so this leaves the resins and tarry products of oxidation and partial combustion, water, dirt, soot and other carbonaceous materials, sediments, etc. in the

precipitate. By mixing the oil sample and naptha in proportions as directed and then centrifuging, the percentage by volume of the "solid" sediment in the bottom of the tube can be read.

Experience shows that buildup of contaminants can be controlled up to a point by changing filter elements. Generally, a buildup is due to clogged filters. Some reading on the tube is selected as an index for replacement. B & W Lines have set their limit at 0.2.

While filter changes will prolong the useful life of the oil, there comes a time where it is cheaper and better to change the oil then to buy enough replacement elements to clean it up. B & W Lines have set this limit at 0.6. (Note: The figures given correspond to ASTM Precipitation Numbers. The Gerin precipitation tube uses only half the oil sample specified in the ASTM test and so actual tube readings are half the above amounts).

Water and Sediment testing is done in a similar manner. However, the proportion of oil to solvent is much higher and the solvent used is benzine in which the tarry and resinous materials are soluable. This leaves only the inorganic materials mentioned in the previous test.

Also as before, percentages by volume (corresponding to a standard ASTM test) are selected as indices for filter and oil changes. In the case of the B & W Lines, these are 2.0 and 6.0 respectively. The Gerin W & S centrifuge tubes use only a quarter of the sample volume specified by ASTM for this test so the tube reading are one quarter of the values given.

The precipitate is broken down into (a) water; (b) solids; and (c) wear metal. Relative percentages are estimated. Water is easy to distinguish. The solids are the soot, carbon particles, dirt, sand, etc. Wear metals are further broken down into ferrous and non-ferrous categories by response to a magnet and/or color.

Neutralization Number is a measure of oil acidity. It is probably the least important of the tests in this service, since the inhibitors in the oil, plus the fortification obtained as makeup oil is added, are generally high enough to neutralize acids formed from one oil change to another. Mr. Heiber uses it just to be sure that acidity never builds up to critical levels.

Technically, the Neut Number is the amount of KOH (postassium hydroxide) in milligrams required to neutralize acids in one gram of oil. Here, the test is made by mixing measured amounts of oil and Gerin's Neutral Solution (indicator) and an amount of KOH equivalent to the limiting Neut Number—0.6 mg for example. If the KOH is more than sufficient, the indicator will be pink and the oil is okay. If it is colorless or stained yellowish or brown, the oil fails and should be dumped.

Procedures

Now we know what is tested and how. It remains to integrate this program into the overall maintenance setup. It starts when a bus comes in for a 2000-mile inspection. Shop men take a sample from the crankcase with a special sump pump and put it in properly labeled bottles.

It was at this point that another source of saving was found. Standard procedure calls for an incoming bus to go through the gas stand where it is checked for fuel, oil and water. This was occurring even with buses due for inspection. Make-up oil was added if needed. If the inspection called for an oil change, this new oil went out with the rest.

This has been stopped. Buses for inspection bypass the service stop and are tagged to prevent their use in case of an emergency until they are serviced. After the inspection and a test of the oil, the necessary action is taken and the bus released for operation. A fairly substantial saving is realized by this simple coordination of procedures.

Oil samples are run through the testing procedure and the results noted in lubrication records of the particular bus. Instructions are given to the shop to add or dump, depending upon the findings. Other maintenance instructions, based on the tests, are also passed on. This is the phase of lube oil control resulting in savings that never show up on the cost sheets.

For example, a sharp reduction in viscosity (high dilution) would call for a check of injectors or search for a fuel leak. If undetected, this could lead to total failure. Or, in this type of service, condensation is an unlikely source of much water and so its presence usually indicates a leak. Heiber states that the tests led to early detection of a cracked liner in a Hall-Scott, three Fords with leaking head gaskets and two with block cracks. Further damage, interruption of schedules and costs of a road failure were avoided.

Precipitation Number and Water and Sediment tests somewhat duplicate each other, but besides serving as a cross check, each offers definite clues. For example, a

First Results with Lube Oil Control Program

Make Buses	Ford	ACF-Brill	Twin Coach
No. Buses	23	12	8
No. Months	19 (1949-51)	12 (1950-51)	12 (1950-51)
Total Bus Mi.	976,000	922,000	594,000
No. Tests	488	461	297
No. Oil Changes	126	83	56
Av. Mi. Oil Change	7746.03	11,108.43	10,607.14
No. Filter Changes	267	181	96
Av. Mi. Filter Change	3655.43	5093.92	6187.50
Gal. Oil Saved	633 1/2	1032 1/2	370
No. Filter Saved	221	49 1/2	52 1/2
Gross Oil & Filter	$758.89	$867.15	$390.83
Saving	$270.74	$255.77	$164.78
Test Cost Labor &	$488.15	$611.38	$226.05
Matl.		$1325.58	
Net Saving			
Total Net Saving			

Note: these 43 buses were taken out of the fleet of 83 because they were operating 70% of total milage.

marked increase in Precipitation Number without a corresponding increase in Water & Sediment would show a buildup of the deposit-forming tarry and resinous materials. Besides pointing at ineffective filtration, this could also indicate poor combustion. Low compression, faulty injectors, or perhaps a plugged air filter might be the cause. Dirt buildup would lead to a check of the effectiveness of air filtration.

There is a lot that can be told about the engine by these simple lube oil checks. It only takes a little experience and common sense.

Some $$ Results

Gus Heiber will tell you that maintenance for its own sake is the bunk; it has to pay off in cash benefits. It can be in terms of better, more dependable operation or in cash savings. When you can combine the two, you hit the jackpot.

Before starting the lube oil control program, oil and filters were changed in the Fords at 2000 miles, and in the ACF-Brills and Twin Coaches at 4000 miles. After setting up a means to evaluate the oil's condition, accurate records were kept on each type of bus. Take a look at what happened over a period from October 1st, 1949 to March 1st, 1951, for the Fords and from February 1st, 1950, to March 1st, 1951, for the other two makes. The consolidated results are given.

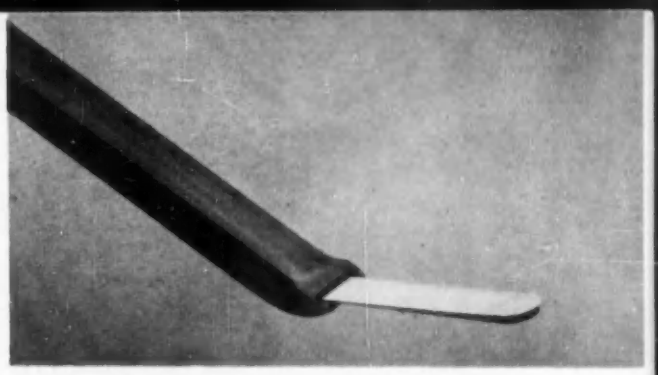
Savings shown represent the difference between the actual cost and the computed cost of oil and filter replacement under the old 2000-4000 mile setup. Note that the cost for testing is deducted. As experience was gained, lube oil and filter life has been extended. In long-haul buses the average mileage for filter changes is 13,000 and for lube oil changes is 30,000.

Two things have happened: maximum condemning factors, still with safety, have been found; and overall maintenance improvement, with the lube oil control data as a tool, has removed a lot of the causes of contamination.

The program as it affects the diesels is still in evolution. By last October they had covered 402,000 miles and 201 oil tests had been made. Filters had been replaced 36 times for a little better than an 11,000 mile average. Lube oil changes have been at an average of 20,000 miles. Gus Heiber says he isn't through yet and doesn't know how high he can push the limits.

He also makes a very good point when he says, "Beware of averages". One feature of the lube oil control is that it considers all the variables of *each* engine—its age, make, general condition, etc. This means that you don't have to set one standard for all engines based on the needs of the poorest. By the same token, averages are just that, averages—too high for safe operation of some engines and too low and wasteful for others.

He also contends, and with ample reason, that a lube oil control program developed on a simple, commonsense basis will pay big dividends and help keep the high-cost-of-maintenance monkey off your back.



Bearing Clearances Checked with Unique Feeler Gauge

NOW bearing clearances on large and medium sized diesels can be measured without dismantling the engine or taking leads. This can be done with the Kjaer bearing feeler gauge, made by Burmeister & Wain American Corp.

Kjaer bearing feeler gauges are in the form of long steel sheaths enclosing a sliding steel rod. The actual feeler shim is attached to the end of the rod and can be pushed out of the sheath by pressing the other end. The thin flexible shim is inserted between the bearing and the top of the journal to check the clearance.

The feeler gauges are available in sets of five and are of the following dimensions: 0.004, 0.008, 0.012, 0.016 and 0.020 in. They may also be obtained stamped in millimeters.

This new tool checks actual working conditions of crankshafts. In large or medium sized diesels unit pressures may be greater on the inner bearings than on the end ones. This is due to greater loads caused by the relative positions of adjoining crank throws. For example, in a 6-cyl engine the five inner bearings may wear faster than the ends.

If these bearings are allowed to wear without being checked and adjusted they will gradually cause crankshaft misalignment. The result is higher stresses in the crankshaft if it is operated under this condition. Studies of crankshaft failures indicate that at least 50% are due to incorrect lining-up of bearings. Perhaps if main bearing wear had been checked more frequently some of these failures may not have occured.

Because of the difficulty and length of downtime involved, crankshaft alignment and bearing clearances are not likely to be checked as frequently as they should be. As a result the engine may run with a misaligned crankshaft due to some unevenly worn main bearings. An instrument such as the Kjaer gauge can quickly and economically detect this condition. Proper precautions can then be taken to avoid costly breakdowns.

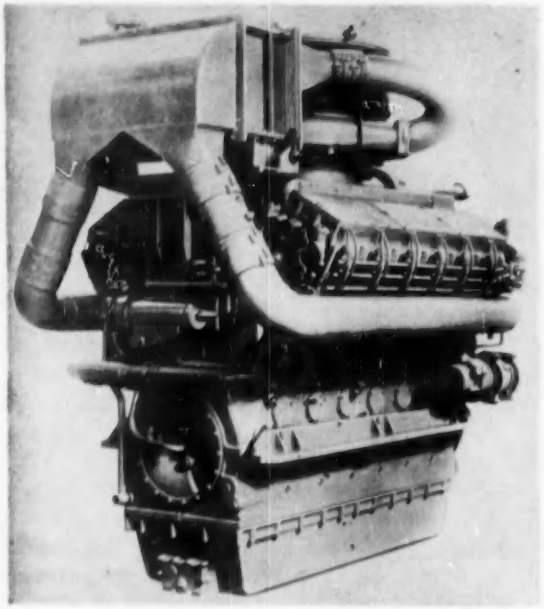


Fig. 1 Power for B-L-H's new locomotive will be furnished by engines like this V-12 Maybach Type MD turbocharged, intercooled diesel.

Power for B-L-H Lightweight Locomotive

Baldwin's bid for the lightweight locomotive business will be powered by a Maybach engine driving through a mechanical-hydraulic transmission. Power train details are discussed.

RAILROADS must do something and do it quickly to get back the passengers they have been losing for years. Somehow severe economies must be effected, service made faster and passenger comfort increased.

Baldwin-Lima-Hamilton's answer to this challenge is a diesel road locomotive driven through a torque converter hydraulic transmission instead of by electric traction motors. Two of these locomotives will be delivered to the New York, New Haven & Hartford, and one to New York Central sometime during 1956.

These engines will power high-speed, light-weight, low-center-of-gravity trains. The two B-L-H units will handle the New Haven's "Train X" between Boston and New York, with one unit on each end of the train. A similar train will be handled on the New York Central with one locomotive unit. These locomotives can run up to 120 mph under favorable conditions of straight level track.

Weight of the Central unit will be approximately 136,000 lb, while the New Haven units will weigh about 150,000 lb each. Two 150-hp electric motors will provide propulsion through the underground approaches to Grand Central Station. A motor-generator set will provide auxiliary power for lighting, air conditioning, and heating while underground. These account for the heavier weight

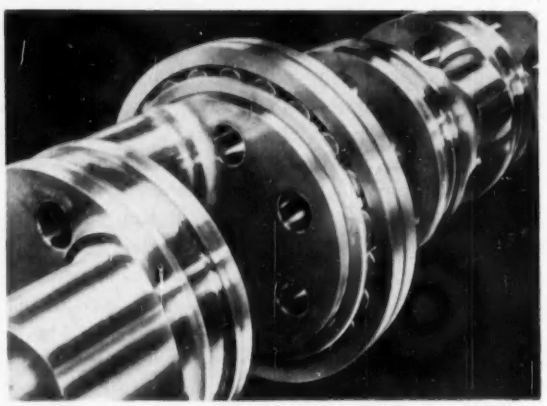
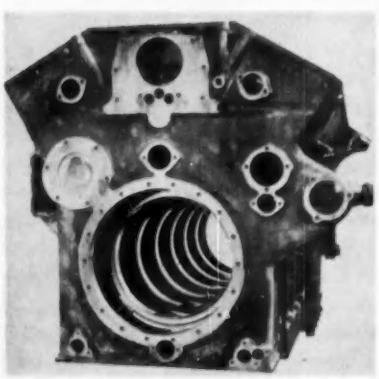


Fig. 2 Crankshaft design is a departure from the conventional. Webs are disc-shaped and serve as the inner races for the roller main bearings. Block for the V-12 is shown below. It's easy to see why this engine carries the nickname "tunnel" engine.



of the New Haven units. The locomotive height will be 11 ft as compared to the conventional 14 ft and the length will be 58-ft, 9-in.

Power Units

German-built Maybach high-speed diesels will furnish both auxiliary and main propulsion power. (B-L-H is the only Maybach licensee in the U. S.)

The propulsion engine is a Maybach 12-cyl, vee-block type MD-655 rated 1000 hp at 1500 rpm. It will drive through a Maybach *Mekydro* hydraulic transmission, which consists of a torque converter and gear transmission box having four speeds forward and four reverse.

Power will be delivered to the wheels through Baldwin's own design of axle drive units, one on each of the two driving axles.

Engine and transmission will be mounted as an assembled unit on a 4-wheel power truck located under the front end of the locomotive. The 4-wheel truck under the rear end is not powered. When more than ordinary maintenance is required, such as replacement of principal parts, the chassis can be lifted. Then the entire power unit drive assembly including the truck is replaced by a spare assembly.

Maybach Engine Features

The Md-655 has an average weight of approximately 10 lb per hp. This is about one-half that of some American design locomotive diesels. The space occupied by the engine is about in the same proportion, or less.

Crankcase—In Europe this unit is known as the Maybach "Tunnel" engine. It has a cast iron or welded steel crankcase of very deep section carried well down below the crankshaft centerline. The word "Tunnel" comes from the shape of the crankshaft housing which accomodates the large-diameter main roller bearings of the crankshaft.

Crankshaft—Crankshaft design differs from conventional practice in that the crank webs have been shaped into solid discs. These discs serve as inner races for the main roller bearings. The outer races fit into machined recesses in the "Tunnel" of the crankcase when the crankshaft is in place. This particular form of main roller bearings permits close spacing of cylinders with resultant shorter lengths of crankcase and crankshaft.

These two features give exceptional stiffness to the whole engine frame structure, providing good bearing area. Its high resistance to bending and torsion means freedom from objectionable crankshaft torsional vibrations and from crankshaft whirl.

Connecting Rods and Bearings— Vee-type MD engines are provided with blade and fork-shaped connecting rods. The crank pin bearing is steel-backed with lead-bronze lining and has a protective covering.

Pistons—The cast iron piston has a heat-resistant steel crown. Cooling is accomplished by a separate closed oil circuit with a pump of its own and oil is cooled in a heat exchanger by the engine cooling water.

Piston cooling oil is led through a telescopic tube, through passages in the piston to the underside of piston

Fig. 3 Cast iron pistons are fabricated with a removeable steel crown which carries the compression rings. Pistons are oil-cooled by a separate pump in a closed circuit.

Fig. 4 Fork-and-blade type connecting rods are used in the vee engine. The blade rod (not shown) rides on a bearing surface which is integral with the back of the bearing inserts.

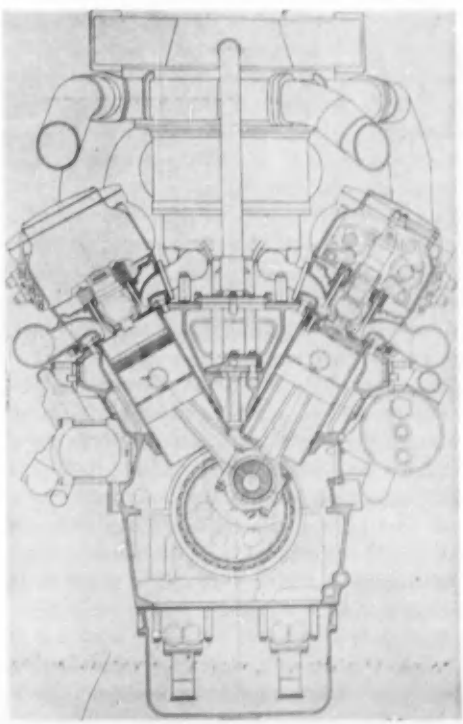


Fig. 5 Cross-section through the vee-type engine. Note the wide-throated precombustion chamber.

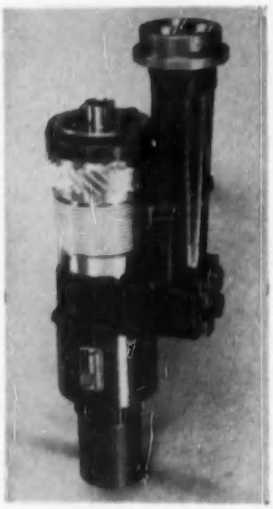


Fig. 6 Unit injectors are of a design which permits large quantities of fuel to be injected into the precombustion chamber (see Fig. 5) in a very short space of time.

crown and distributed around back of the ring lands. It then flows out through a wide opening below the piston crown and lubricates the wrist pin. The amount of oil in the circuit is large and the rate of flow, though fast, varies with the engine speed. These factors prevent any tendency for ring-sticking at maximum load despite a high bmep. The lower and more even heat condition in the piston and around the top of liner permits piston clearances to be kept smaller than usual without any ill effect. This also permits thin wall-thickness of the piston.

Only three piston rings are carried in the steel crown. The grooves, being cut in steel, are said to be subject to minimum wear. Construction is such that after cylinder head removal, an examination of rings may be made by removing six set screws, and lifting out the steel piston crown containing the three rings.

Cylinder Liners—Liners are made of cast iron and water circulates around them in the same way as in American-designed engines. Water space around the liner is sealed at top and bottom where it passes through the frame.

Heads and Valves—Cylinder heads are individual iron castings, employing three inlet and three exhaust valves arranged concentrically. This arrangement makes possible a very rigidly constructed head casting having relatively thin walls and good heat transmission. By the use of six valves in each head the heat load per valve is kept small.

Each cylinder bank has two camshafts above the cylinder heads, one for the exhaust valves, the other for the inlet valves and injection devices. Motion is transmitted to the valves by rocker arms with rollers on the cams and valve lateral motion is eliminated by use of sliding guide covers.

Combustion System—The valve arrangement makes it possible to place a large, approximately spherical-shaped pre-combustion chamber in the center of the cylinder head. It has a large connecting throat formed by a separate piece of heat-resisting steel. The throat diameter is so large that the losses of the usual precombustion chamber through gas exchanges are almost eliminated.

A combination pump plunger and injection valve with pintle type nozzle is located in the center of combustion chamber.

Gases leaving the combustion chamber first hit the cooled piston crown which is the least sensitive to the effect of such jets. The valves are not subject to the direct effect of the gas or unequal heating.

A special governor regulates power by means of a shaft which controls all injection units of each cylinder bank.

Exhaust gas turbocharging is applied to this MD engine through the Maybach vertical shaft arrangement of the turboblower.

The various engines in the MD-series are practically alike differing only in the number of cylinders. Almost all parts are interchangeable, only the crankcase, crankshaft, camshaft and the valve control frame are different.

This feature has been capitalized upon by also using auxiliary power units of Maybach design. On the New Haven units a 6-cyl, vertical-in-line Maybach rated 465 hp at 1200 rpm, with a 250-kw generator will furnish head end power for lighting, air conditioning and heating. On the Central unit this service will be provided by an 8-cyl, vee-block Maybach rated 570 hp at 1200 rpm, operating a 300-kw generator.

Hydraulic Transmission

The *Mekydro* transmission consists mainly of a hydraulic torque converter; a 4-speed forward gear mechanism with four reverse speeds—including Maybach's over-running clutch with interlocking claws; and a control mechanism. All are housed in a single oil-tight cast iron casing, see Figs. 7 & 8.

The pump wheel, of the torque converter (1) which is permanently filled with oil, is driven by the engine through the flange coupling at the left end of top shaft, a step-up pair of gears (2) and a hollow shaft.

The turbine wheel is engaged and disengaged (see Fig. 8) through operation of an oil pressure cylinder (3). The turbine wheel acts as a quick-disconnect coupling due to its blading being removed from the fluid circuit when in a disengaged position. In this position a second ring of blades is brought into the fluid circuit, giving a weak backward torque, tending to bring into synchronism the gears to be coupled.

The 4-speed gear arrangement itself is driven by the secondary part. A shaft (4), inside the pump drive shaft, drives the gear mechanism which includes three pairs of gears, a-b, c-d, and e-f, all constantly in mesh. Speed changes are carried out by changes of clutch couplings (5). This operation is fully automatic depending on the relation of vehicle speed and engine load.

Direction of rotation of transmission output drive coupling (8) depends on whether the upper or lower gear wheel (6) has its clutch engaged as both are constantly in mesh with gear (7) which drives (8).

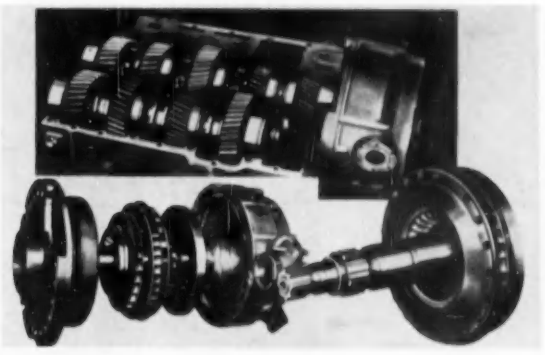


Fig. 7 Maybach Mekydro transmission (right) with exploded view of disengaging converter including housing and end plate below. Assembly at lower right is the converter's pump wheel and turbine.

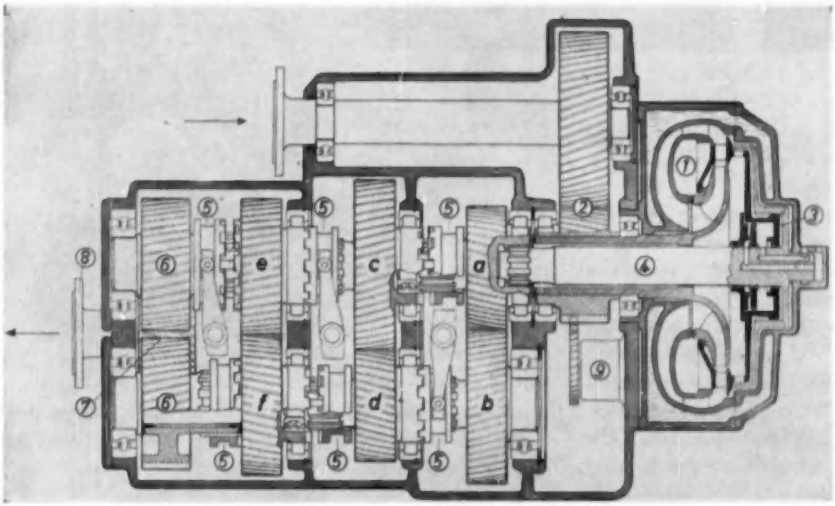


Fig. 8 Longitudinal cutaway of Mekydro transmission. Operation is explained in text.

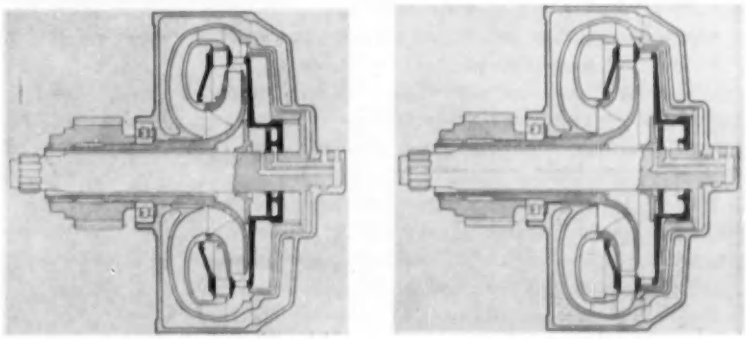


Fig. 9 Longitudinal cutaway through disengaging converter showing action of hydraulic cylinder for disengaged position (left) and service position (right). At left, reaction blading is moved laterally out of fluid circuit. At right, it functions for torque multiplication.

A gear type pump (9) supplies oil to the control mechanism, feeds the converter, and lubricates the transmission.

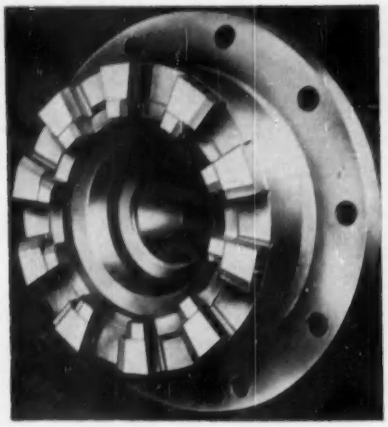
The converter is surrounded by a cooling jacket through which the engine cooling water flows.

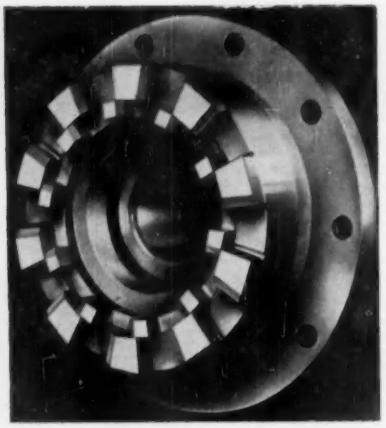
The few parts of the Mekydro transmission subject to wear such as the gears, ball and roller bearings, etc., are generously proportioned. Because the hydraulic converter and clutch couplings are scarcely exposed to wear, the transmission assembly requires minimum maintenance.

Maybach Clutch

The gear coupling used in the transmission mechanism is a development of an over-speed gear generally adopted by the motor car industry. This gear coupling will not engage from a declutched position as long as there is a difference in speed between the driving sleeve and the gear to be coupled. The clutch claws, because of their oblique faces, repulse each other without engaging even though under light pressure. Clutching takes place when the row of claws turning at a lower speed begins to overtake the opposite claws which are in the lead. Only an increase or decrease in speed of the driving parts is required to make this change.

With the development of over-running claws into interlocking claws this principle became applicable to high engine outputs where inertia masses of the gears to be coupled are always increasing. Despite this, wear on the faces and edges of claws is still said to be almost impossible.





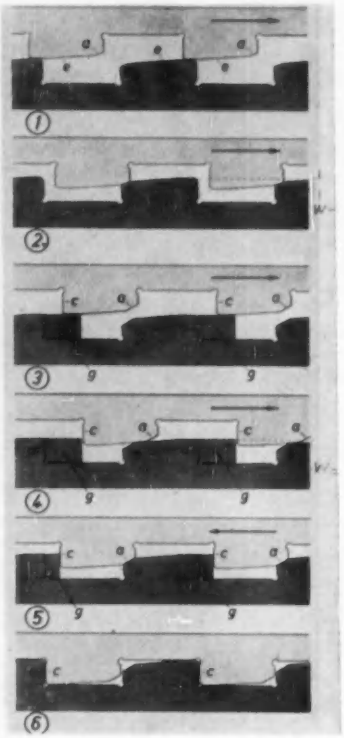


Fig. 10 A, B, & C shows Maybach's interlocking-claw type, over-running clutch in clutching position (left) and blocking position (above). Action of clutch is shown at right and detailed in the text.

The Maybach over-running clutch with interlocking claws is the basic element which made possible this 4-speed hydraulic transmission. (See Fig. 10 A, B, & C, sketches 1 to 6 inclusive.) In the construction of the Maybach over-running claws, the front face of the claw is provided with two different inclinations; a steep one on "a" and "b" and a flat one on "e". The motions of the claw ring in the axial direction during repulsion, sketch (1) and (2), can be carried out over a relatively large distance "W." This causes corresponding inertia forces on the gear shift forks and change-speed cylinders.

To keep inertia forces and clutching pressure small, the over-running clutches are provided with an interlocking clutch ring. It is arranged concentrically (inside) in relation to the clutch ring which transmits the power. In the disengaged position of the clutches it covers a part of the clutch gap by means of a spring.

In this way the inclined faces "a" and "b" cannot touch each other during repulsion procedure, and the axial reciprocating motions of the clutch rings are limited to distance W_2 (sketch 4).

With inversion of the relative movement, the claw along the inclined faces "a" and "b", sketch (5), dips into the gap, while by the edge "c" the interlocking spring-return clutch is simultaneously pushed back as shown. Power is transmitted only when faces "c" and "d" are fully applied to each other, sketch (6).

Because of small inertia forces and low clutch pressures large outputs can be transmitted indefinitely without wear.

Control Mechanism

Fig. 11 shows that this device works by oil pressure. The speed change is fully automatic depending on vehicle and engine speed. The operation is as follows:

At the moment of change-over the change regulator "R" driven by the primary and secondary sides moves the speed selector "A" by one notch into the next gear-change position. This is done through a distributing slide (piston) valve. Then the speed selector supplies oil pressure to the respective change-speed cylinders "B" and "C" which are provided for shifting the clutch rings in the speed-change gear. These cylinders however cannot disengage the claws from their existing clutch position as long as the converter is not disengaged. This disengagement is made in such a manner that simultaneous with the pressure oil supply to the cylinders "B" and "C", the converter slide "E" is also operated by means of controller slide "D" admitting oil to pressure cylinder (3). This action causes the converter to become disengaged. The claw rings are then disengaged from their existing position and applied to the respective opposite claws of the new clutch position.

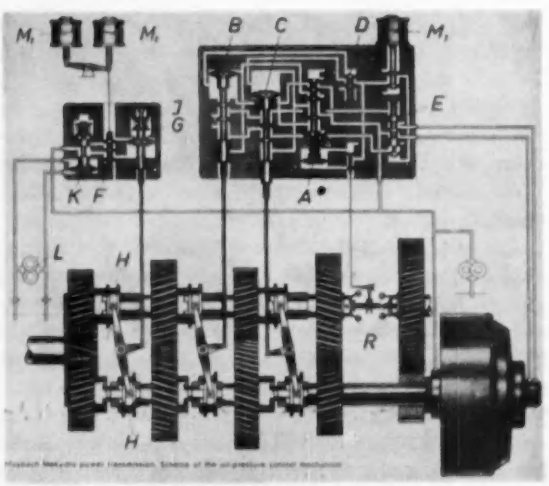


Fig. 11 Hydraulic control diagram. Functioning is covered in text.

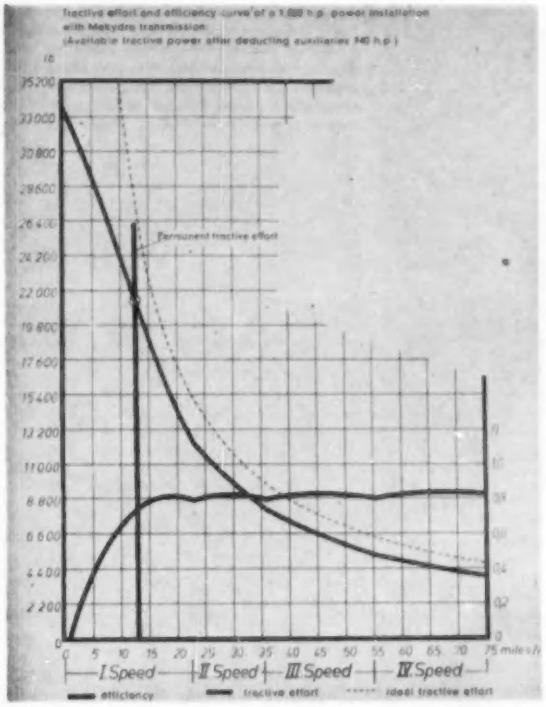


Fig. 12 shows how closely the tractive effort curve parallels the ideal tractive effort curve. Note also how efficiency increases rapidly in first speed and remains near maximum throughout remainder of range.

If the speed is increased or decreased the forward or backward blading is put into motion for a short time. This is done by means of a control impulse produced by the piston rods of cylinders "B" and "C", by which the parts to be coupled are brought through the state of synchronism, and the over-running claws take their clutch position.

Once the over-running claws have been locked, the control impulse disappears and the converter resumes the working position. The speed-change procedure, which takes only a fraction of a second, is then finished. A delaying device avoids any oscillation around the change-over point.

In reversing, a distributing slide (piston) valve "E" actuated by a reverse lever in the operating cab is moved by the energizing of one or the other of the two magnets M_1 and M_2. These are mounted on the transmission gear case. According to the position of the reverse mechanism, oil under pressure is applied to either side of piston "G" by which the reverser sleeves "H", also fitted with over-running claws, are moved into one or the other final positions. As soon as the engine is stopped distributing oil pressure ceases and the reverser sleeves "H" through action of a spring "J" move into the intermediate position. This causes the power flow to the driving axles to be interrupted.

Engineer's Controls

After the engine is started and the reverse lever moved to the forward or reverse position the locomotive unit is ready to move. On moving the engine throttle to the driving position the converter is engaged by means of magnet M_3, and the locomotive unit is put into motion. All other operations are automatic.

The reversing mechanism is so protected that even if the engineer moves the reverse lever before the vehicle stops the actual change-over takes place only at stand-still. This effect is obtained because the hydraulic locking piston of movement. This is done by an oil pump "L" which always circulates oil when the locomotive is in motion. This prevents oil pressure from being applied to the other side of piston "K" before the locomotive stops.

Fig. 12 shows that the tractive effort curve is a continuous smooth line lying close to the theoretical hyperbola of constant engine output. The steep rise of the efficiency curve after the start indicates high starting efforts and great acceleration. The succeeding flat part of curve shows continuing high efficiency at high top speeds.

Operation being mostly in a highly favorable efficiency range of the converter the losses by heating of the liquid at low speeds are small. Since the converter portion of the transmission always remains filled with oil and airtight, a higher oil temperature is permissible in the circuit without affecting the oil quality. Therefore any normal engine lubricating oil may be used in the converter. Another advantage of this oil-filled converter is the quick response resulting when the throttle is opened. An immediate smooth starting movement of the locomotive is obtained.

Combined features of the transmission makes it equally adaptable for motive power to haul fast passenger trains, time freight, or heavy slow speed freight, and also for switching power. The quick throttle response, the great driving range and the fact that maximum efficiency is attained at one-half the top track speed makes Mekydro particularly suitable to switching power. It is possible from about 10% of top speed upwards to transmit full tractive efforts continuously. On switchers the continuous tractive effort can be obtained at a still lower proportion of top speed by suitable sizing of the radiator.

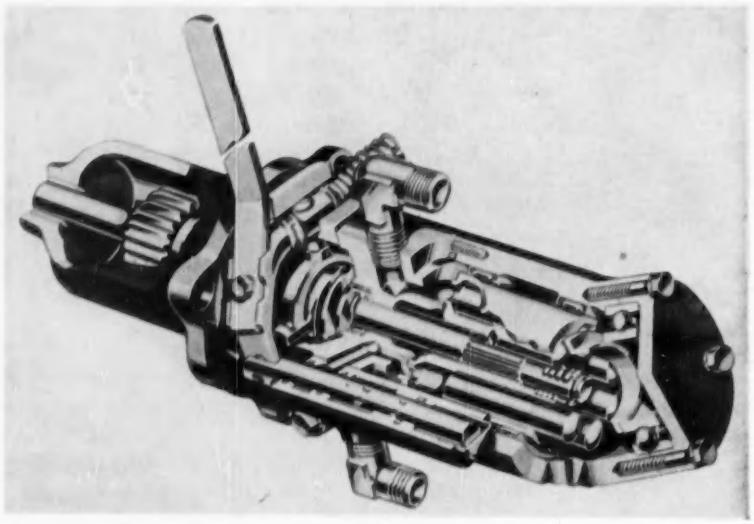
According to Maybach, in the most rugged railway service the transmission has combined all these characteristics to obtain reliability over long periods of service with extremely low maintenance expenses.

Conclusion

The advantages anticipated by the use of these locomotives are essentially economy and faster service. The economy will be obtained in several ways. Fuel savings of approximately 40 to 50% are expected since the trailing tonnage is much lower than on present trains. Further savings will come from the reported low engine fuel consumption.

Additional economy will come from the anticipated reliability which is expected to reduce maintenance costs and cut down time to a minimum.

These savings together with faster schedules will go a long way toward the recapturing of passengers who have turned to other forms of travel.



Relationship of hydraulic motor components. Lever engages pinion in ring gear and opens hydraulic valve. Oil enters elbow at top, flowing through porting to the pistons. Oil released on other half of revolution flows out bottom elbow. Bearing in angular housing supports wobble-plate that pistons contact.

Hydraulic Starting for GM Diesels

Allison's new hydraulic starting system provides the high torque necessary for developing adequate cranking speed even at very low ambient temperatures.

WHEREVER diesel engines are used, a good reliable starter is basic equipment. Battery-electricity, compressed air, a gasoline engine, or hydraulic fluid are the four powering mediums available today. Each has its advantages, depending on the type of installation and conditions encountered. Although the design and operation of these systems are different, they all have three essential components which perform similar functions: a power supply, a power storage device, and a cranking device.

General Motor's Allison Division has made its entrance into the starter business with the newest of the four systems—the hydraulic starter. Stressing simplicity as the keynote of their system, they say their "Hydrostarter" will give positive starts in any climate at all times, be easy to install and service, and require no special skills in maintenance.

Their system makes use of a pressurized mixture of diesel fuel and lubricating oil to turn a hydraulic motor which in turn starts the diesel. This process is accomplished by an assembly of five basic units interconnected by flexible lines and fittings: an oil reservoir, a hand pump, an engine-driven pump, a piston-type accumulator, and the hydraulic motor.

Component Functions

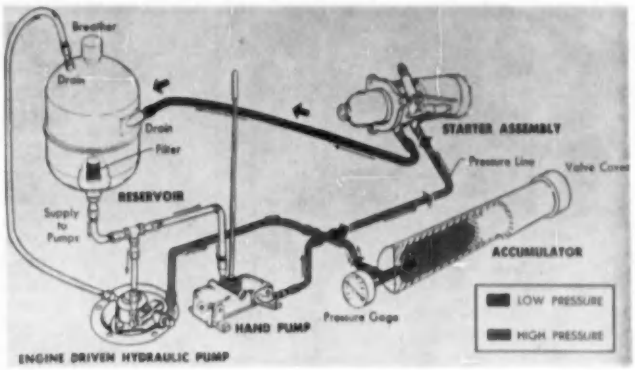
In the cycle of operation, the *hand pump* is used to produce initial starting pressure when the system is newly installed. A long lever is provided for this purpose. The hand pump is also used if the hydraulic pressure of the system has been released or to raise pressure to meet increased starting torque requirements. In less than five minutes, a maximum recommended pressure of 3000 psi can be pumped into the system.

Maintenance of proper pressure in the system is accomplished by the *engine-driven pump*. It is driven by the camshaft on all Series 71 engines and is belt-driven from an auxiliary drive on Series 51 and 110 engines. The pump is equipped with a built-in relief valve to bypass oil back to the reservoir whenever the 3000-psi pressure is reached. This pressure build-up is achieved in about seven minutes.

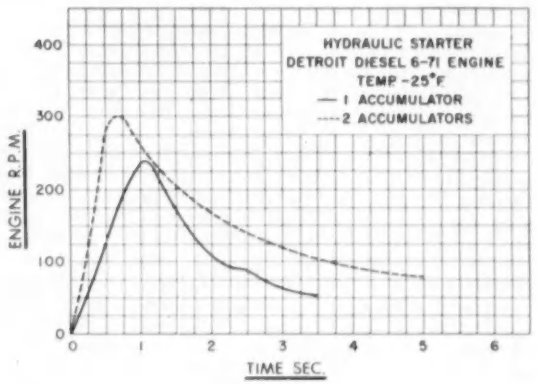
The *reservoir*, which supplies both pumps, has a top breather fitted with an air cleaner to prevent dust entry. An oil filter is installed at the bottom of the reservoir to screen out foreign matter.

The *accumulator* is the power storage device in the system. It is a heavy-duty cylinder separated into two sections by a floating piston. Nitrogen is preloaded on one side of the piston and then sealed at 1250-psi pressure. When oil under pressure from either pump enters the accumulator through a check valve, it forces the piston back to compress the nitrogen gas to a 3000-psi pressure. The gas thus acts like a pneumatic spring work-

Oil flow during starting operation. With engine running, starter valve blocks oil flow and engine-driven pump builds up accumulator pressure again.



Results obtained with both one and two accumulators when cranking at minus 25°F.



ing against the piston to provide pressurized oil to the hydraulic motor.

The accumulator will normally hold this pressure for months, GM states, and will make hand pumping unnecessary even after long periods of engine inactivity. A gauge is attached to indicate how much pressure is available for starts and also to spot an oil leak in the system.

The *starting motor*, a wobble-plate type, mounts on the engine flywheel housing to accomplish the cranking action. To fit different installations, both right and left hand starters are available. The control lever has four positions and is reversible for accessibility whatever the starter mounting. The motor has a positive engagement pinion that is mechanically meshed with the ring gear before full oil pressure is applied.

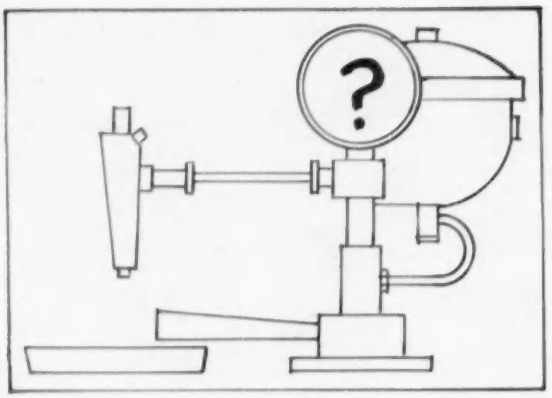
The system is activated by pushing the starting lever forward, mechanically engaging the starter pinion with the ring gear. Upon this action, a control valve opens to allow a small flow of oil from the accumulator to turn the pinion slowly into full engagement and contact. An overrunning clutch also protects the starter against being engine-driven before disengagement of the pinion.

When the control valve has been fully engaged, pressurized oil flows from the accumulator to the motor. The motor converts this pressure into a high turning force and transmits it to the starter pinion in the following manner. An end plate incorporated in the motor housing has both inlet and outlet porting. Against this end plate, one end of a centrally located rotor bears. Axially distributed around this rotor are bores for seven pistons. The open end of the piston bores, all at the same radius and in tight contact with the end plate, are aligned with the end plate porting. Outer end's of the pistons are rounded and bear against a ball bearing-mounted wobble plate which is tilted to a 30-deg angle.

Oil entering the valve is admitted through the inlet port segment of the end plate, exerting pressure on the pistons whose bores align with the inlet porting. Because of the angular contact of the pistons on the wobble plate, the pistons are forced to "slide down" a circular ramp. And in doing so, they must move laterally and thus turn the rotor. As each piston reaches the bottom of the ramp, the top of its bore now aligns with the outlet port segment of the end plate. Pressure is relieved and as the piston is pushed up to the top of the ramp, oil is displaced through the outlet port to the reservoir. This cycle is repetitive and since all piston bore aligned with the inlet porting are under full pressure, high torque can be developed.

The effect of the operation is a rapid rotation of the starter pinion providing the necessary acceleration and torque for starting the diesel engine. When the engine is running, and the 3000-psi pressure has been reached, oil will be bypassed in the engine-driven pump and returned to the reservoir. All other lines, with the exception of that from the starter to the reservoir, will be at 3000 psi.

GM has put the new system through various weather-condition tests. One of the first, made last year in a tractor equipped with a 6-71 diesel, showed the importance of adequate fluid filtration. Dust-proving trials were conducted on a dragline loading sand, a scraper, and a rock crusher. Other field installations were made on an irrigation pump and a feed grinder. And a cold weather test was conducted on a farm tractor in the deep of winter. Results of the tests indicated that one basic assembly was all that was necessary to handle all the installations.



Nozzle Test Data

KNOWLEDGE of accurate nozzle opening pressures is a basic requirement when testing nozzles. Having the necessary equipment for testing and servicing nozzles and knowing how to use it isn't enough if accurate data is not available. This data, tabulated in ready-reference form was compiled from information received from manufacturers of high speed engines.

After removing the nozzle from the cylinder head and plugging the hole, it should be cleaned and tested before disassembly. Unnecessary handling of internal parts does more harm than good. Outside dirt may be introduced. If the tests meet the specified limits, *leave it alone.*

Dirt is a major enemy and a good flushing may well put the nozzle back in good operating condition. Also don't try to bring it back to "new" settings if it is in the acceptable operating range. Manufacturer's recommendations compensate for the expected "set" that occurs when nozzles are used. If exterior tip cleaning and flushing makes it meet specifications, *don't take it apart.*

If taken apart handle nozzle parts carefully and keep them clean. Then this data can be used to advantage.

Some manufacturers give orifice diameters in millimeters but here they're listed in thousands of an inch. We feel that this is more practical because the drills or music wire used to clean them are measured by the English system in this country. The same holds true for the micrometers used to check their diameter. If conversion is necessary, 1 millimeter=0.039 in.

The following symbols give the key for easy reading of the tabulated nozzle specifications.

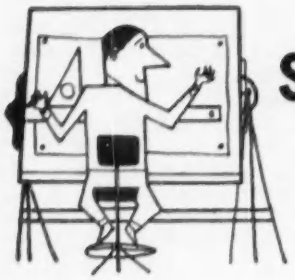
Legend

O - Own	T - Screw
H - Hole	S - Shim
N - None (Replace)	P - Pintle
B - American Bosch	D - Demco
C - C A V	L - Capsule
SH - Sheppard	BS-Bendix-Scintilla

Engine Model	Noz. Mfr. & Type		No. & Size of Orifices	Noz. Popping Pres. (PSI) When New	When Used	Min.	Adj. By	Hold Down Torque (Ft Lb)
Allis-Chalmers Mfg. Co.—Buda Div.								
2BD-77	B	—	P 1-0.039"	2000	2000	2000	T	12-15
4BD-153	B	—	P 1-0.039"	2000	2000	2000	T	12-15
6BD-230	B	—	P 1-0.039"	2000	2000	2000	T	12-15
6DT-317	B	—	P 1-0.039"	2000	2000	2000	T	12-15
6DTM-317	B	—	P 1-0.039"	2000	2000	2000	T	12-15
6DT-468	B	—	P 1-0.039"	2000	2000	2000	T	12-15
6DTM-468	B	—	P 1-0.039"	2000	2000	2000	T	12-15
6DA-779	B	—	P 1-0.059"	2000	2000	2000	T	12-15
6DA-844	B	—	P 1-0.059"	2000	2000	2000	T	12-15
6DC-1879	B	—	P 1-0.059"	1800	1800	1800	T	12-15
6DCM-1879	B	—	P 1-0.059"	1800	1800	1800	T	12-15
6DAS-844	B	—	P 1-0.059"	2000	2000	2000	T	12-15
6DAM-844	B	—	P 1-0.059"	2000	2000	2000	T	12-15
6DASM-844	B	—	P 1-0.059"	2000	2000	2000	T	12-15
8DA-1125	B	—	P 1-0.059"	2000	2000	2000	T	12-15
8DAM-1125	B	—	P 1-0.059"	2000	2000	2000	T	12-15
8DAS-1125	B	—	P 1-0.059"	2000	2000	2000	T	12-15
8DASM-1125	B	—	P 1-0.059"	2000	2000	2000	T	12-15
4DC-645	B	—	P 1-0.059"	1800	1800	1800	T	12-15
6DCS-1879	B	—	P 1-0.117"	1800	1800	1800	T	12-15
6DCSMR-1879	B	—	P 1-0.117"	1800	1800	1800	T	12-15
8DC-2505	B	—	P 1-0.117"	1800	1800	1800	T	12-15
8DCS-2505	B	—	P 1-0.117"	2000	2000	2000	T	12-15
6DA-273	B	—	P 1-0.039"	2000	2000	2000	T	12-15
6DAS-516	B	—	P 1-0.059"	2000	2000	2000	T	12-15
6DA-970	B	—	P 1-0.059"	2000	2000	2000	T	12-15
8DA-1290	B	—	P 1-0.059"	2000	2000	2000	T	12-15
8DC-1125	B	—	P 1-0.059"	2000	2000	2000	T	12-15
8DC-1290	B	—	P 1-0.059"	2000	2000	2000	T	12-15
8DCS-1125	B	—	P 1-0.059"	2000	2000	2000	T	12-15
8DCS-1290	B	—	P 1-0.059"	2000	2000	2000	T	12-15
4BD-182	B	—	P 1-0.039"	2000	2000	2000	T	12-15
Caterpillar Tractor Co.								
D311	O	—	L 1-0.025"	750	750	750	N	100
D315	O	—	L 1-0.025"	750	750	750	N	100
D318	O	—	L 1-0.025"	750	750	750	N	100
D326-F	O	—	L 1-0.028"	750	750	750	N	100
D337-F	O	—	L 1-0.028"	750	750	750	N	100
D339	O	—	L 1-0.025"	1750	1750	1750	N	100
D342	O	—	L 1-0.025"	1750	1750	1750	N	100
D364	O	—	L 1-0.029"	750	750	750	N	100
D375	O	—	L 1-0.029"	750	750	750	N	100
D386	O	—	L 1-0.029"	750	750	750	N	100
D397	O	—	L 1-0.029"	750	750	750	N	100
Continental Motors Corp.								
ZD-129	C	—	P 1-0.039"	1900-1950	1850	1750	T	15
GD-157	C	—	P 1-0.039"	1900-1950	1850	1750	T	15
ED-201	C	—	P 1-0.039"	1900-1950	1850	1750	T	15
HD-260	C	—	P 1-0.039"	1900-1950	1850	1750	T	15
JD-382	C	—	P 1-0.039"	1900-1950	1850	1750	T	15
HD-243	C	—	P 1-0.039"	1900-1950	1850	1750	T	15
TD-427	B	—	P 1-0.057"	1900-1950	1850	1750	T	15
RD-572	B	—	P 1-0.078"	1900-1950	1850	1750	T	15
TD-6427	B	—	P 1-0.057"	1900-1950	1850	1750	T	15
RD-6572	B	—	P 1-0.078"	1900-1950	1850	1750	T	15
SD-802	B	—	P 1-0.078"	1900-1950	1850	1750	T	15
SD-6802	B	—	P 1-0.078"	1900-1950	1850	1750	T	15
HD-277	C	—	P 1-0.039"	1900-1950	1850	1750	T	15
VD-603	B	—	P 1-0.057"	1900-1950	1850	1750	T	15
VD-8603	B	—	P 1-0.057"	1900-1950	1850	1750	T	15

Engine Model	Noz. Mfr. & Type	No. & Size of Orifices	Noz. Popping Pres. (PSI) When New	When Used	Min.	Adj. By	Hold Down Torque (Ft Lb)
Detroit Diesel Div.—G. M. Corp.							
Series 51	O — H	(1) 10-0.005"	450-850	350-850	350	N	35-38
Series 71	O — H	(2) 8-0.005"	450-850	350-850	350	N	20-25
Series 71	O — H	(3) 6-0.006"	450-850	350-850	350	N	20-25
Series 71	O — H	(4) 7-0.006"	450-850	350-850	350	N	20-25
Series 71	O — H	(5) 7-0.006"	450-850	350-850	350	N	20-25
Series 110	O — H	(6) 7-0.007"	450-850	350-850	350	N	30-35
Series 110	O — H	(7) 7-0.007"	450-850	350-850	350	N	30-35
(1)—37 Cu mm Injec.							
(2)—LE8 - 60 Cu mm Injec.							
(3)—HV6 - 60 Cu mm Injec.							
(4)—HV-7 - 70 Cu mm Injec.							
(5)—HV-8 - 80 Cu mm Injec.							
(6)—90 Cu mm Injec.							
(7)—110 Cu mm Injec.							
Fairbanks, Morse & Co.							
45B3⅛	D — P	1-	1750				
45B4⅛	D — P	1-	1750				
49B4½	B — H	1-0.018"	3000	3000	2800	T	18
48A3	SH — H	1-0.042"	2300				
48A3½	SH — H	1-0.042"	2300				
48A4	SH — H	1-0.043"	2300				
48A4¼	SH — H	1-0.036"	2300				
Gray Marine Motor Co.							
D-157	B — P	1-0.039"	1800	1800	1750	T	14-16
D-181	B — P	1-0.039"	1800	1800	1750	T	14-16
D-260	B — P	1-0.039"	1800	1800	1750	T	14-16
D-427	B — P	1-0.057"	1800	1800	1750	T	14-16
D-572	B — P	1-0.078"	1800	1800	1750	T	14-16
D-129	B — P	1-0.039"	1800	1800	1750	T	14-16
Hallett Mfg. Co.							
AC1	B — P	1-0.040"	1800	1800	1700	T	20
D1	B — P	1-0.040"	1800	1800	1750	S	20
D2	B — P	1-0.040"	1800	1800	1750	T	20
AC2	B — P	1-0.040"	1750	1750	1700	T	20
WC1	B — P	1-0.040"	1750	1750	1700	T	20
WC2	B — P	1-0.040"	1750	1750	1700	T	20
WC4S	B — P	1-0.040"	1750	1750	1700	T	20
Hercules Motors Corp.							
DIX-83	B — P	1-0.078"	1725	1650	1600	T	
DIXC	B — P	1-0.078"	1525	1450	1400	T	
DIXD	B — P	1-0.078"	1525	1450	1400	T	
DIX4B	B — P	1-0.078"	1725	1675	1650	T	
DIX4D	B — P	1-0.078"	1725	1675	1650	T	
DOOB	B — P	1-0.078"	1725	1650	1600	T	
DOOC	B — P	1-0.078"	1725	1650	1600	T	
DOOD	B — P	1-0.078"	1725	1650	1600	T	
DIX6D	B — P	1-0.078"	1725	1675	1650	T	
DIX6-272	B — P	1-0.078"	1725	1675	1650	T	
DJXB	B — P	1-0.078"	1725	1650	1600	T	
DJXC	B — P	1-0.078"	1725	1650	1600	T	
DJXH	B — P	1-0.078"	1725	1650	1600	T	
DJXHF	B — P	1-0.078"	1725	1650	1600	T	
DWXC	B — P	1-0.078"	1725	1650	1600	T	
DWXD	B — P	1-0.078"	1725	1650	1600	T	
DWXLD	B — P	1-0.078"	1725	1650	1600	T	
DWXLDF	B — P	1-0.078"	1725	1650	1600	T	
DRXB	B — P	1-0.078"	1725	1650	1600	S	
DRX-501	B — P	1-0.078"	1725	1650	1600	S	
DRXC	B — P	1-0.078"	1725	1650	1600	S	
DFXB	B — P	1-0.078"	2100	2000	1950	S	
DFXC	B — P	1-0.078"	2100	2000	1950	S	
DFXD	B — P	1-0.078"	2100	2000	1950	S	
DFXE	B — P	1-0.078"	2100	2000	1950	S	

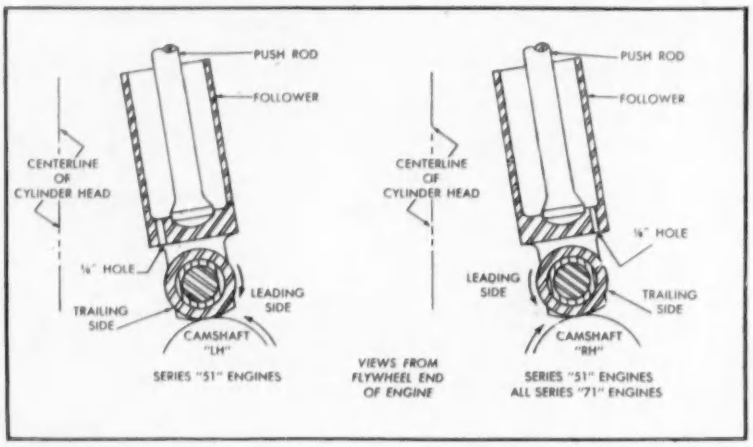
Engine Model	Noz. Mfr. & Type	No. & Size of Orifices	Noz. Popping Pres. (PSI) When New	When Used	Min.	Adj. By	Hold Down Torque (Ft Lb)
Hercules Motors Corp. (Continued)							
DFXETS	B — P	1-0.078"	2100	2000	1950	S	
DFXH	B — P	1-0.078"	2100	2000	1950	S	
DFXHF	B — P	1-0.078"	2100	2000	1950	S	
DNXV8C	B — P	1-0.078"	2100	2000	1975	S	
DNXV8D	B — P	1-0.078"	2100	2000	1975	S	
DNXV8DTS	B — P	1-0.078"	2100	2000	1975	S	
International Harvester Co.							
UD-264	O — L	1-0.036-0.037"	740-750	700-710	700	T	20-25
UD-350	O — L	1-0.047-0.048"	740-750	700-710	700	T	45-50
UD-14A	O — L	1-0.036-0.037"	740-750	700-710	700	T	45-50
UD-525	O — L	1-0.047-0.048"	740-750	700-710	700	T	45-50
UD-18A	O — L	1-0.036-0.037"	740-750	700-710	700	T	45-50
UD-1091	O — L	1-0.047-0.048"	740-750	700-710	700	T	45-50
Mack Mfg. Corp.							
END-510	B — P	1-0.057"	1850-1925	1700-1750	1700	T	14-17
END-5672	B — P	1-0.057"	1850-1925	1700-1750	1700	T	14-17
END-673	B — H	4-0.012"	2530	2300-2350	2000	T	14-17
ENDT-673	B — H	4-0.012"	2530	2300-2350	2000	T	14-17
Minneapolis—Moline Co.							
D-283	B — P	1-0.039"	1800	1800	1750	T	14-16
D-425	B — P	1-0.039"	1800	1800	1750	T	14-16
D-605	B — P	1-	1800	1800	1750	T	14-16
Harnischfeger Corp.—P & H-Diesel Div.							
	B — H	1-0.018"	3000	3000	2800	T	18
ALL	D — H	1-0.028"	2200	2200	2000	T	18
MODELS	BS — H	1-0.032"	2200	2200	2000	S	18
R. H. Sheppard Co. Inc.							
6	O — H	1-0.042"	5-8	5-8	5		
13	O — H	1-0.042"	5-8	5-8	5		
16	O — H	1-0.043"	5-8	5-8	5		
17	O — H	1-0.036"	5-8	5-8	5		
Sterling Engine Co.							
AB-6	B — P	1-0.039"	1650	1650	1350	S	75
DB-6	B — P	1-0.057"	1650	1650	1350	S	75
DB-8	B — P	1-0.057"	1650	1650	1350	S	75
VD-6	B — H	10-0.0128"	3300	3300	3000	S	75
VD-6-S	B — H	10-0.0128"	3300	3300	3000	S	75
VD-8-S	B — H	10-0.0128"	3300	3300	3000	S	75
Waukesha Motor Co.							
180-DLC	B-C — P	1-0.057"	1950-2000	1800	1600	T	12½-16½
185-DLC	B-C — P	1-0.057"	1950-2000	1800	1600	T	12½-16½
190-DLC	B-C — P	1-0.057"	1950-2000	1800	1600	T	12½-16½
190-DLCA	B-C — P	1-0.057"	1950-2000	1800	1600	T	12½-16½
195-DLC	B-C — P	1-0.057"	1950-2000	1800	1600	T	12½-16½
195-DLCA	B-C — P	1-0.057"	1950-2000	1800	1600	T	12½-16½
135-DK	B-C — P	1-0.039"	1850-1900	1700	1500	T	12½-16½
135-DKB	B-C — P	1-0.039"	1850-1900	1700	1500	T	12½-16½
135-DKBS	B-C — P	1-0.039"	1850-1900	1700	1500	T	12½-16½
148-DK	B — P	1-0.039"	2150-2200	2000	1800	T	12½-16½
148-DKB	B — P	1-0.039"	2150-2200	2000	1800	T	12½-16½
148-DKBS	B — P	1-0.039"	2150-2200	2000	1800	T	12½-16½
WAKD	B-C — P	1-0.039"	2150-2200	2000	1800	T	12½-16½
WAKDB	B-C — P	1-0.039"	2150-2200	2000	1800	T	12½-16½
WAKDBS	B-C — P	1-0.039"	2150-2200	2000	1800	T	12½-16½
NKDB	B-C — P	1-	2150-2200	2000	1800	T	12½-16½
NKDBS	B-C — P	1-	2150-2200	2000	1800	T	12½-16½
LRDB	B — P	1-	1950-2000	1800	1600	T	12½-16½
LRDBS	B — P	1-	1950-2000	1800	1600	T	12½-16½
VLRDB	B — P	1-	1950-2000	1800	1600	T	12½-16½
VLRDBS	B — P	1-	1950-2000	1800	1600	T	12½-16½



service section

Recent engine and equipment modifications, procedures and recommendations straight from the different manufacturers to you

GM-Installing Cam Follower Assemblies Series "51" & "71" Engine . . .



Most of the lubrication for the contact surfaces between the camshaft lobes and the cam follower rollers in Series "51" engine units is supplied by oil which has been forced through grooves in the camshaft bearings. The lubrication of these surfaces in Series "71" engine units depends upon oil which collects in the lower section of the camshaft cavity of the cylinder block and is splashed or carried around by the cam lobes.

Additional lubrication for the roller of the cam follower assembly in Series "51" and "71" engine units is provided by oil from the top deck of the cylinder head as it drains down the inside of the cam follower body and out through a ⅛-in hole in the lower end of the body.

In order to prevent the possibility of foreign particles that may be present in the lubricating oil from passing between the cam follower roller and the mating surface of the camshaft lobe, the cam follower assemblies are installed in the cylinder heads of engine units so that the ⅛-in oil hole is located over the trailing side of the roller; thus, during engine operation, each roller and cam lobe will centrifugally cast-off most of these foreign particles before they reach the contacting surfaces.

Cam follower assemblies should be installed with the ⅛-in oil hole facing toward the outside of the cylinder head in all Series "71" engine units and in right hand rotating Series "51" engine units.

Cam follower assembles should be installed with the ⅛-in oil hole facing toward the center of the cylinder head in all left hand rotating Series "51" engine uits.

International Harvester—Exhaust valve seat, oversize—Model UD-1091 Engines . . .

To assure maximum valve and valve seat insert life, it is essential that the insert be installed to obtain maximum contact with the bottom and sides of the counterbore. In this way only can proper heat dissipation be obtained.

In the event inserts are not sufficiently tight there is the possibility they will work loose, allowing carbon to collect on the outside of the insert, thus preventing good dissipation of heat through the head.

The cylinder head must be machined to a depth of 0.427-0.423 and to a diameter of 2.201-2.200—after cleaning the sides and bottom of the counterbore to assure a good tight fit. The insert rings and suitable driver tool having been chilled with dry ice for one-half hour, a few light blows with a hammer should set the ring in place. Next use a suitable peening tool, peen the head material around the entire edge of the insert.

Standard Exhaust valve seat inserts are not available for service. Oversize 0.015 inserts only are available for service.

news of our industry

First Australian-Built Alco

Delivered slightly ahead of schedule, this 1600-hp diesel locomotive, the first of six ordered, is now in high-speed passenger and freight service in the South Australian Railways. It was constructed under terms of a licensing agreement with A. E. Goodwin, Ltd., of Sydney, under which Alco Products, Inc. builds the diesel engines in its Auburn, N. Y. plant and the Australian firm fabricates all other major components.

The remainder of the railroad's order is expected to be completed in May. Called World-Locomotive units and designed especially by Alco for overseas service, they are said to combine all the advantages of mass-produced components with the addition of braking, coupling, and other equipment adapted to foreign standards. To meet the requirements of international clearances, they can be built to operate on every track gauge ranging from one meter—the narrowest, to 5 ft 6 in—the widest. The same type is now seeing service in Spain and Pakistan.

Huge Van Norman Camshaft Grinder

Primarily designed for the regrinding of 2000-hp diesel locomotive camshafts, this new cam-contour duplicator has been purchased by Cleveland Hone Co. It is a new production of Van Norman Automotive Equipment Co., a division of Van Norman Industries, Inc. of Springfield, Mass.

Shown from left to right at the presentation ceremonies are Jack F. Smole, president of Cleveland Hone; Francis Healy, Van Norman's chief engineer who designed the machine; Steve Szaban, Van Norman service engineer; and Joseph Smole, vice president of Cleveland Hone.

A diesel locomotive is estimated to average 30,000 miles a month, or 350,000 miles a year. When one million miles have been run, the locomotive is rebuilt and it is then that the camshaft is reground. Details on this machine may be had for the asking from the manufacturer.

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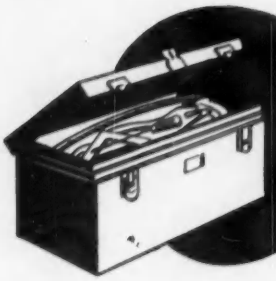


Straight from the Tool Box

This is YOUR Department. Pass along your ideas to the other fellow. Send items to the Editor, preferably with a picture or sketch. Contributors will receive $10.00 for each item upon publication.

Reconditioning Disc-Type Valves

FRANK C. LOUGHEED, VICTORIA, B.C.—Reconditioning of air compressor disc-type inlet and discharge valves is simplified and speeded up with my new tool.

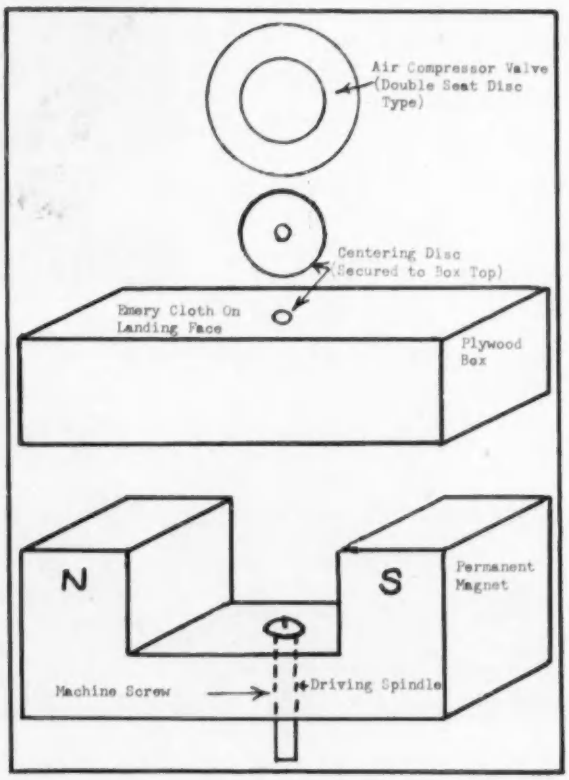
It consists of a horseshoe type permanent magnet over which you place a close fitting plywood box with an open bottom. The box is covered with 80-grit emery cloth. This is held to the box top by a mild-steel centering disc. This disc is thinner and almost equal to the inside diameter of the double-seat disc valve.

A machine screw through the center of the magnet forms a spindle for driving the centering disc. The spindle is clamped to an electric drill which is held in a vise.

The spindle drives the centering disc which in turn drives the box since it is secured to it. When the valve disc is placed over the centering disc it is held against the emery cloth by the influence of the magnet through the box top and therefore turns with the unit.

With grinding compound on the valve disc and the drill turning slowly hold the seat lightly against the valve. To prevent ridges from forming on the valve seat allow the seat to take up a slightly eccentric position, working to and from the true center of the tool. The drill speed is controlled by turning it on and off.

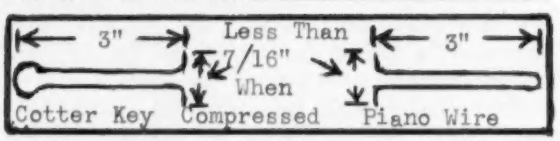
Before reconditioning an assembly I test the valve and seat by rubbing each against a blued surface plate. This shows up the high spots and gives an indication of how much grinding is necessary and the grade of compound to use. After these high spots have been ground off I finish with a No. 3 grade Clover compound.



This tool is a variation of a magnetic chuck and is applied well. Time can be saved by also using this tool on disc-type valves on crankcase scavenging diesels. Drill speed can also be controlled by gearing or belt drive. Ed.

Removing I-H-TD24 Oil Pan

ROBERT F. NEUZIL, FALLBROOK, CAL.—Removing and installing the oil pan on the TD 24 International Harvester without removing the oil pump saves much time and labor. One way which I have found to be quick and simple is as follows. Drop the pan in the usual way but put a 4-in to 6-in, 7/16-in USS bolt in the center hole in front of the pan to hold it level.



Remove the two oil scavenging lines held by three ⅜-in USS cap screws in each line. Remove the 7/16-in USS bolt and lower the pan slightly moving the front end of the pan to the tractor right side and the rear end to the left. Tip the pan sideways and lower it.

If the equipment is handy while the pan is off, I grind about 1/16-in from the interfering surfaces on the pan and oil pump. This affords a smoother fit.

When installing the pan I leave the gasket off until the pan is back under the oil pump and held by the 7/16-in bolt and the oil lines are in place. Then I slip the gasket under the pump. I hold the gasket in place with six or eight clips made of cotter keys or piano wire slipped into the bolt holes. Clips are removed as the bolts are started around the pan.

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Standard or Counterbalanced Crankshafts

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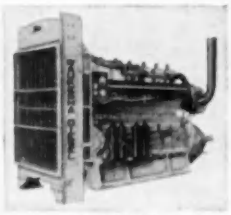
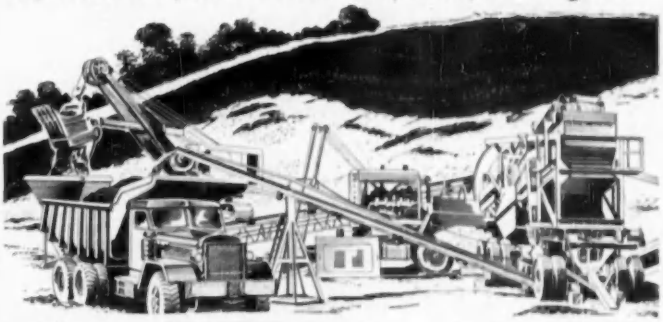
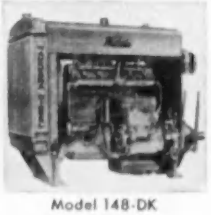
Model VLRDBS



Model LRDBS

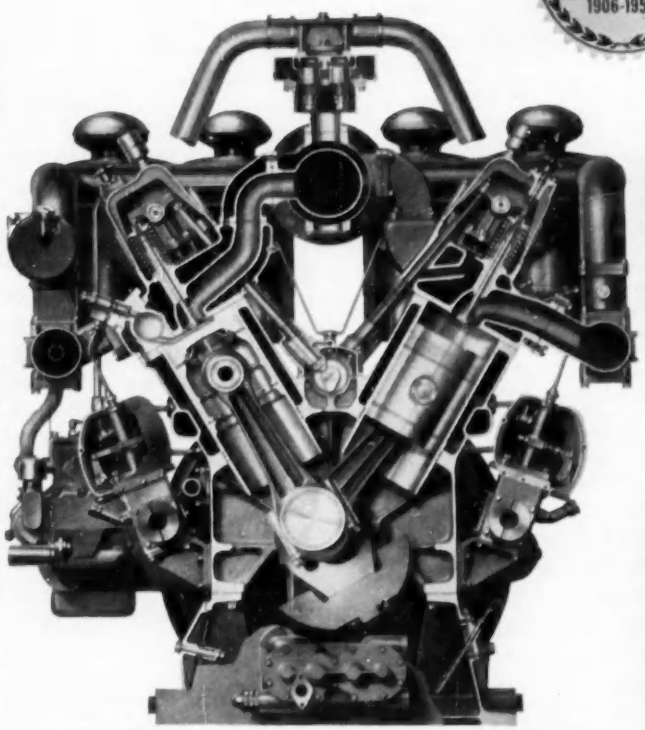


50th ANNIVERSARY Waukesha 1906-1956



Model 148-DK

Model WAKDBS



Model VLRDB NORMAL DIESEL
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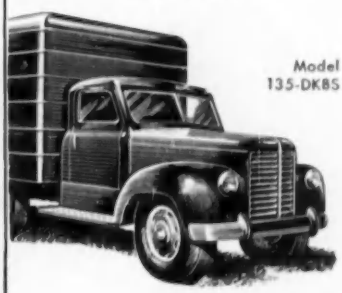
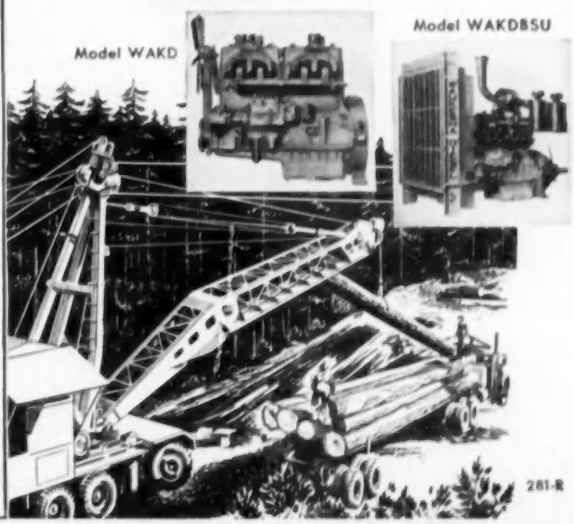
—up to 1135 hp turbocharged



Model 135-DK8S



Model WAKD

Model WAKDBSU

281-R

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news of our industry

Low-Speed Crankshaft Turning

Proper tool geometry is the secret to low-speed machining of crankshafts with cemented carbides, General Electric Co.'s Carboloy Dept., reveals. Coupled with honing the cutting edge, this provides good carbide tool life to make possible boosting of machining speeds from 60 to 70 fpm to about 180 fpm.

Tests were conducted on three different work materials: forged steel, cast steel, and malleable cast iron crankshafts; the forged steel proving the most difficult. Good tool life was achieved with a negative 5-deg rake angle tool, its cutting edge honed at 45 deg to produce a 1/64-in land. Grade 370 carbide was used and was said to produce over twice the tool life of a high-speed steel under low-speed cutting conditions of 60 to 70 fpm.

On cast steel crankshafts, tool life was even better, using the same carbide grade. The malleable cast iron machined similar to ductile cast iron, giving a somewhat continuous chip. It was found here, that Grade 883 carbide gave extremely long tool life. During tests, it was also indicated that if the crankshaft machines were run at maximum speed from the time the tool entered the cut at the cheeks down to the surface of the crankshaft bearing, much higher production rates were possible. It was also found that complicated grinding of the land could be eliminated by use of either throw-away insert tools or 1½-in tangential insert tools.

More Diesels for Penn RR

Augmenting its diesel fleet, the Pennsylvania Railroad has placed an order for 21 all-purpose locomotives with Alco Products, Inc. Sixteen of the units, of 1600-hp each, will be used in freight and switching operations. The others, 2400-hp each, will be used as helper locomotives in passenger service. They're scheduled for delivery before the first of the year. At that date the road's diesel ownership will stand at 2055 units totalling 2,849,370 hp.

news of our industry

Steam Crane Conversion

Midland Iron and Steel Co. has accomplished conversion of a steam locomotive electromagnet crane to diesel power, featuring a variable-speed DC generator and eliminating a gasoline engine-driven generator. In the past, it was stated, any workable arrangement for electromagnet cranes required a separate generator to produce a constant source of DC.

One engine was not practical since as its speed varied, so did the voltage and output, resulting in the load also dropping. Magnet crane operation requires a constant voltage and full output regardless of load. A separate gasoline DC generator, usually of 10 kw, also has greater fuel costs than the main engine, along with high maintenance costs.

Martin-Roasa Tractor & Equipment Co., a Caterpillar dealer in Cedar Rapids, Iowa, approached Midland with a plan for a variable speed DC generator which could supply enough current at low idle to lift a load of steel or scrap. To test the idea, the company purchased an old 25-ton industrial Brownhoist locomotive crane equipped with a 45-in electromagnet.

A Caterpillar D318 diesel engine with a Twin Disc torque converter was installed to power both the crane machinery and the variable speed generator, the engine delivering 100 hp at 1600 rpm. The generator, belt driven from front power takeoff with a 1:1 ratio, was double-ended and had a through shaft. A pulley was rear-mounted on the shaft to belt drive a 40-cu in Westinghouse air compressor supplying air for the crane air-actuated controls and brakes.

Success of the installation is evidenced by the intention of Midland to replace the 45-in magnet presently used with a 55-in magnet, expected to increase loading capacity almost 30%. The converted crane now also serves as a switcher to speed up loading and unloading operations, at times moving four to five gondola cars, each weighing 80 ton loaded. Conversion cost of the crane was approximately $15,000 including adjustments, crane parts, engine, and labor of both buyer and seller. A new crane of comparable capacity is estimated to cost approximately $55,000.

Governor Companies Combine

Curtiss-Wright Corp. announces that it has acquired the Massey Machine Co., Inc., hydraulic governor manufacturer, to supplement the governor line of Marquette Metal Products Co., a wholly-owned subsidiary. The consolidation is expected to enable furnishing of a complete line of hydraulic governors for every application.

Under the program of manufacture, the acquired firm will continue its operations in Watertown, N. Y., as a division of Marquette. Research and engineering facilities will be combined and research has been started in the field of centrifugal and other types of engine control to develop new methods of speed regulation.

Issue Mobilization Register

First major revised edition since Jan. 1954 of the list of planned mobilization producers under the Production Allocation Program is being distributed to military installations and activities. The "Register of Planned Mobilization Producers", formerly published in a 3-volume edition as the "Alphabetical Register of Planned Wartime Material Suppliers", now lists in one volume about 30,000 manufacturers who have planned or are developing detailed mobilization production schedules for specific military items.

The new edition lists plants of all sizes and firms whose mobilization production could be converted to military needs during an emergency. Although classified as confidential, the register will be available for inspection by a firm for its specific entry only. To determine registration, the nearest major armed force office may be contacted. These include the Navy's Offices of Inspector of Naval Material, Army Ordnance Districts, District Engineer's Offices, and Air Force Procurement Districts.

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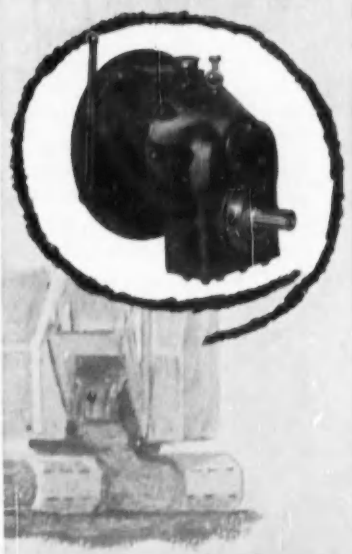

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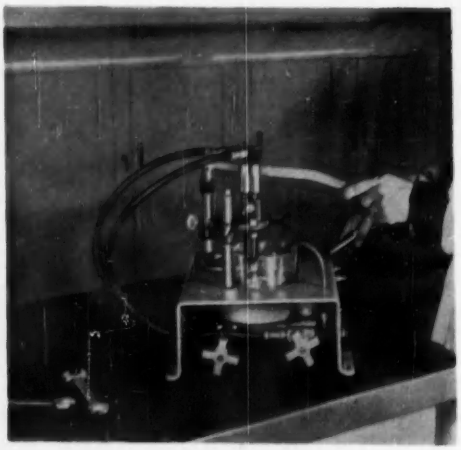


Detroit Diesel Injector Tester

You can now check all GM Detroit Diesel injectors on one tester with no major change in setup, Kent-Moore Organization, Inc. announces. All six tests: rack freeness, plunger freeness, spray pattern, valve opening pressure, holding pressure, and high pressure specified for all Series 51, 71, and 110 engine injectors can be performed on its new J 700. Adaptability to all three series is made by changing the threaded end connectors.

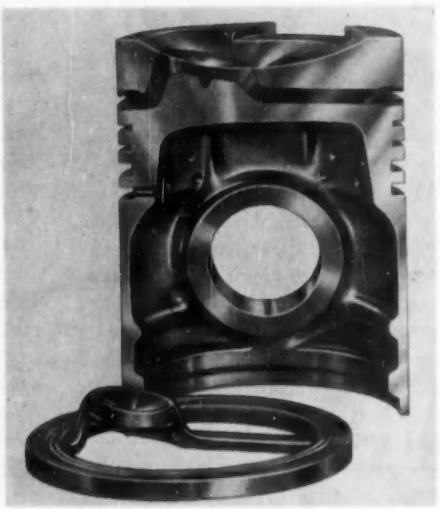
Features include a plastic container for unobstructed viewing of the spray pattern, a positive-lock fine-adjustment popping handle for checking leaks at higher than normal valve opening pressure of the injector, a fine-mesh screen and 10-micron filter to guard against fuel system contamination, and a 3000-lb gauge with "lazy" hand for faster testing. The complete tester includes the basic testing unit (J 5764) plus three adapter sets: J 705-1, J 7070-1, and J 7110-1 for testing 51, 71, and 110 injectors respectively.

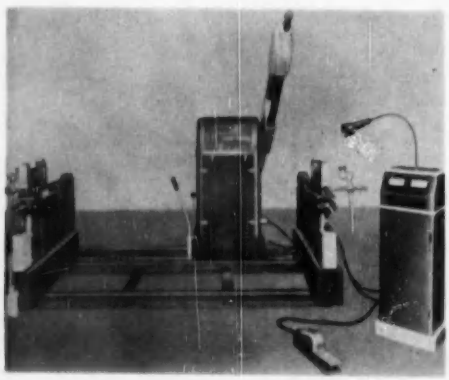
Purchase of adapters may be made separately in any combination.

"Hot-Spot" Piston

This piston, the manufacturer asserts, will effectively end piston "head burning" in diesel engines where fuel impinges on the piston, or those which have auxiliary combustion chambers emitting streams of hot, high-velocity gas. Such engines often suffer from erosion of the piston crown due to consistent application of heat to a relatively small portion of the piston.

United Engine & Machine Co., makers of Dualoy and Silvolite pistons, say they have avoided "crown burning" in this new piston by incorporating a button or hot-spot of Ni-resist in the crown, molecularly bonding it to the aluminum piston body by Fairchild's Al-fin process. The button is cast integrally with the top ring carrier insert, also Ni-Resist for increased groove life, and also molecularly bonded. This bond, they claim, is superior to the mechanical bonding of iron buttons to aluminum and will overcome any loosening resulting from the difference in expansion rates of the two metals under heat. The pistons are being produced in models and sizes appropriate to heavy-duty engines.





Electronic Balancer

Merrill Engineering Laboratories, maker and distributor of Stewart-Warner electronic industrial balancers, has added this large-capacity Model 708 to its line. Claim is that it will dynamically and kinetically balance any rotor weighing as much as a 2½-ton locomotive traction generator or as little as a 1-lb flywheel. This model is also to sell for 50% less than others in its range.

The machine has a diametrical range of from 1 to 68 in on any rotating piece, kinetic sensitivity of .04 in-oz, dynamic sensitivity of .25 in 2-oz. It has remote handle-controlled starting, braking, and speed adjustment; a walking and locking mechanism for length adjustment; and choice of flat belt friction or direct drive. About 2-min of setup time is necessary.

new products

Hydrocarbon-Curbing Muffler

Clayton Mfg. Co. announces it has developed a muffler for automotive engines which eliminates more than 95% of the hydrocarbons passed into the atmosphere from unburned and partially burned fuel. First of the new units will be for gasoline-driven heavy-duty truck and bus engines in the range of 550- to 750-cu in displacement. Models for diesel-powered equipment and passenger cars are still being worked on.

A number of the mufflers have been in operation for more than a year on buses in the Los Angeles and Portland, Ore. areas. The experimental work is being closely followed by the Automobile Mfrs. Assn.

The new muffler is said to embody a different principle from anything on the market now. According to Clayton, the stream of exhaust from the engine sucks in sufficient air (oxygen) to cause combustion of the unburned fuel carried into the exhaust system during normal engine operation. The new development, it is stated, provides a means for positive ignition of these unburned gases.

Life expectancy of the mufflers will be greater than standard, it is further stated, and because they contain no catalyst or other deteriorating substances, maintenance will be minimum. Although the mufflers will be slightly larger, they will be interchangeable with others now in service. Clayton Clearair Muffler Co. has been established to handle sales and distribution of the product which will be marketed under the trade name of Clayton Clearair.

Quick-Connect Fitting

A thumb and finger are the only tools needed for its new Swagelok fitting, Crawford Fitting Co. announces. It incorporates a shutoff valve which acts as a positive seal to prevent any leakage during the connecting or disconnecting operation. Used with plastic and metal tubing, it comes in all metals and in sizes to fit ordinary applications.

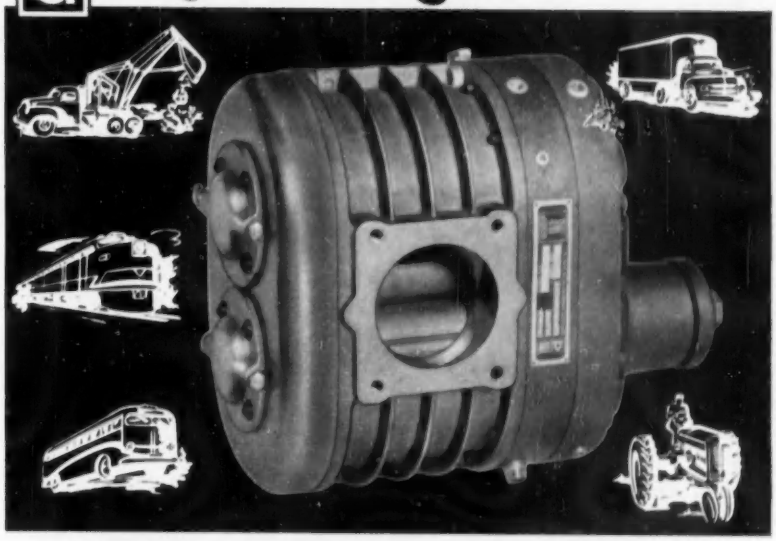
Grease Remover

An emulsion cleaner for removal of oily soil and greases has been produced by Kelite Corp. under the trade name of Ke-Sonic. It may be diluted with up to 20 parts of water, the company states, and used in pressure washing machines. One form known as Ke-Sonic-C is diluted with kerosene, diesel fuel, or No. 2 fuel oil, and then sprayed, brushed, wiped, on the soiled parts; or the parts may be immersed in the solution. Both types are claimed fire safe.

Permanent Dry Lubrication

Useco-Lube is the name given to a permanent dry lubrication process developed by U. S. Engineering Co. for application to all metallic surfaces. Impregnation is said to greatly reduce oxidation, corrosion, and friction, and prevent sticking, with effective lubrication provided at temperatures from 30° below zero to 800° F. To demonstrate its effectiveness, the company will sample-treat metal parts for test purposes without charge.

DIESEL ENGINES NEED
Supercharged Power



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INCREASE HORSEPOWER, TORQUE,
ACCELERATE YOUR ENGINES FASTER

Wherever Diesel engines work—buses, tractors, trucks—a Miehle-Dexter Supercharger adds a big boost to performance. Power is increased by the simple addition of this compact, space-saving supercharger. That means *extra* speed at any load, *extra* pushing or pulling power at any speed, wider speed range. More, it means faster acceleration with less smoke. Add all this to engines without increasing size, weight or cost. In fact, weight per horsepower is decreased. Standard M-D models available for most engine applications. For more facts, call or write Miehle-Dexter.

Soon available AN ENTIRELY NEW TYPE OF TURBOCHARGER

MIEHLE md DEXTER
Supercharger Division
Dexter Folder Company
113 Fourth St., Racine, Wisconsin

Automatically stops the engine . . . if cooling water temperature goes above, or lube oil pressure goes below safe limits. This Sylphon Safety Control No. 530 will shut down small diesel engines direct and sound alarm, or serve as pilot valve to stop gas engines.

Automatically sounds an alarm . . . if water jacket temperature goes above, or lube oil pressure goes below safe limits. Or, this No. 539 Temperature-Pressure Switch will flash a warning light . . . or, if desired, shut down engine operation. "Fail-safe" feature.

Why risk engine trouble?

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PLANT OPERATORS AND ENGINEERS find Sylphon Controls are big helps in guarding internal combustion engines against costly damage and shutdowns. These controls *stay* on duty round-the-clock—when *you* can't be on hand. Find out about these dependable, money-saving, long-lasting Sylphon Safety Controls. Write today for information. Ask for Catalog AD-817.

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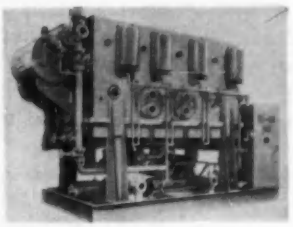
new products



Waste Heat Evaporator

Making fresh, pure water from sea water at the cost of 33c for 1000 gal is the function of a new Cleaver-Brooks Co. waste heat evaporator now in production. This development was described in DIESEL POWER, August, 1955, when it was first utilized in an offshore drilling rig. The production evaporators use waste heat from diesel engines, raising their thermal efficiency from 30% to 60% by greater utilization of the Btu's in the fuel.

The process consists of sending the waste heat through heat exchangers charged with sea water. This sea water is then flashed into a vacuum chamber, which resulting steam is then condensed on cooling coils as distilled water. Operations are carried at less than atmospheric pressures so that no scaling problem arises.

The company has prepared a cost analysis chart which shows that the evaporator can save as much as $161.70 a day over barging in purchased water at 25c a barrel, and a savings of $41.80 a day compared with vapor compression evaporators. Characteristic linear curves show that at less than 80,000 Btu per min, the 4-stage evaporator will produce 1500 gph of pure distillate.

Cold Solvent Cleaner

For removing carbon, grease, and gasket compound, Oakite Products, Inc. has developed Saturol, a high flashpoint compound said to be suitable for use on every type of metal or combination of metals. Parts to be cleaned are simply immersed full strength in the solution and then rinsed with water or kerosene.

Mr. Ford's Idea

WILL WORK FOR YOU, TOO

Henry Ford believed in mass production—in producing so many MODEL T's that the cost per car was brought within everyone's reach.

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with AMERICAN BOSCH "FSA" final stage fuel oil filter

Give your Diesel fuel injection equipment positive protection against damage caused by minute dust and abrasive particles. Install an American Bosch "FSA" Final Stage Fuel Oil Filter. It costs just a few dollars, yet contains an improved water-resistant filtering material that traps all particles that get through primary and secondary filters. The sealed construction is tamperproof . . . installation on any Diesel is quick, easy, inexpensive.

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new literature

Locomotive Traction System
components and a method of assuring better locomotive utilization and easier maintenance are considered in Bulletin GEA 6085, issued by General Electric Co.

400 Electrical Standards
are contained in a 60-page booklet published by the American Standards Assn. Each standard is indexed and described to help the user find the best applicable to his product. The booklets are free as long as they last.

68 Different Rubber Hoses
for every industrial and agricultural use are presented in an 8-page catalog digest by the Thermoid Co. Several are new additions to the company's line. Data on power transmission belting and friction materials are also contained.

Free to Utilities
from Allis-Chalmers Mfg. Co. are handy self-adhesive check-off labels for oil circuit breaker maintenance. Similar to adhesive record forms which filling station operators place on automobile doors, the forms provide a check list for all standard tests, operation counter readings, etc., for control, operator, and breaker.

Instruments for Plant Control
have been catalogued by Bopp & Reuther, Germany, in a set of product folders. The full line of the company is depicted in detail ranging from steam plant valves and meters, positive-displacement and venturi-type flow meters, control panels with recorders, valves and flow controllers for refinery applications, electrical and temperature meters, and level meters.

Flexible Hose and Ducts
of the Flexaust Co. are described in its latest industrial price list catalog. The products are used for moving air, dust, fumes, and materials by means of pressure, suction, and gravity.

Precision Measurement
with its versatile electronic proximity meter, which measures without touching the specimen, is described in a 28-page booklet offered by the Fielden Instrument Div. of Robertshaw-Fulton Controls Co.

A New Welding System
is the title of a technical manual, offering of Metal & Thermit Corp., as a guide to the use of its Croloy electrodes for welding of piping and equipment subject to high temperature and pressure service.

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DIESEL CRANKSHAFTS
and Miscellaneous
DROP FORGINGS
Weighing Up to 4,000 Lbs.

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Dependable Lubrication
in Tough Service

MANZEL
FORCE FEED
LUBRICATORS

Engineered to the Specific Needs
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MODEL K-120
universal peak firing and compression pressure
indicator

The Model K-120 is the only maximum pressure indicator that can be used as a compression tester on small, high-speed engines and as a firing pressure indicator on engines having indicator valves. Patented Kiene diaphragm type check valve of stainless steel has no springs or piston, no complicated adjustments, temperature corrections or pressure loss. Bleeder valve permits release of indicator pressure for repeat readings. This instrument gives true pressure readings with an uncompensated gage.

Adaptors for most models U.S.A. engines. Others made to order at reasonable prices.

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new literature

Nickel Cadmium Batteries
for diesel locomotive starting, railway signal service, switchgear control, emergency power, alarm circuits, and handlights, are the subjects of special bulletins from Nife Incorporated. Engineering data includes capacities, tray dimensions, and typical discharge curves.

22 Points in Truck Evaluation
are listed in a folder from Elwell-Parker Electric Co., making up the major factors to consider when choosing an industrial truck for plant materials handling.

Users of Heat Exchangers
of the shell-and-tube-type, will be interested in a 32-page catalog offered by E. C. Cooley Co., as a guide to equipment selection. Simplified performance curves cover converters, heaters, and processors, which the company markets under the Thermxchanger trade name.

Analyses of Cleaning Problems
are offered in a new booklet available from Magnus Chemical Co. Over 100 types of equipment are illustrated along with technical material to help industrial plants select the method, material, and machine best suited to their needs.

Diesels to the Rescue
when power fails. That's the theme of Caterpillar's latest booklet on its diesel electric sets. It is illustrated with photographs of diverse installations using standby power.

Torque Application Tips
and a handy common bolt-torque chart are featured in an engine torque specification booklet issued by P. A. Sturtevant Co. Recommended torques in foot pounds are given for all trucks and passenger cars as well as some diesel engines and tractors. Although the company has priced the specifications at $1, they are being offered on a complimentary basis to interested readers of this publication.

Filter Applications
and such design considerations as flow rates, fluid viscosities, contamination to be removed, filter costs, space requirements, types of elements, and proper selection of elements are covered in a comprehensive manual of filtration for product designers available from Purolator Products, Inc., for a 25c fee to cover postage and handling.

7-Step Procedure
for repairing concrete floors with new non-shrink mortar is available from The Master Builders Co., which produces Embeco pre-mixed mortar for both indoor and outdoor use.

Railroad Diesel Fuels & Lubes
and their improvement to meet the increasing demands of higher output engines are the concern of the latest issue of "Lubrication" produced by The Texas Co. Various problems associated with these advances, imposing better performance on the oils and fuels, are analyzed.

organizational news

Secretary and Treasurer
now is the official title of Charles E. Nelson, following a board of director's meeting at Waukesha Motor Co. He was most previously vice president in charge of production.

Sales Manager
for industrial original equipment at The Weatherhead Co., is the new post of George R. Anderson, upgraded from special products manager of a new hose swaging program.

George R. Anderson

American Air Filter Elections
have resulted in the elevation of W. G. Frank, former executive vice president, to president. W. M. Reed has risen to chairman of the board, from his post as president. Others shifted were Ben R. Shaver, from secretary-treasurer to vice president and treasurer, and E. G. Mason, from assistant secretary-treasurer to secretary.

A New Manager
is in control of the Cincinnati office of Worthington Corp. He is Ralph G. Griffin, most lately assistant manager, assigned to succeed Earle W. Vinnedge who has been named special representative to concentrate on larger negotiations.

GMC Truck & Coach
Div. of General Motors has appointed Sheldon G. Little assistant chief engineer. He has lately been with the GM Styling Section directing various design development projects with other GM divisions.

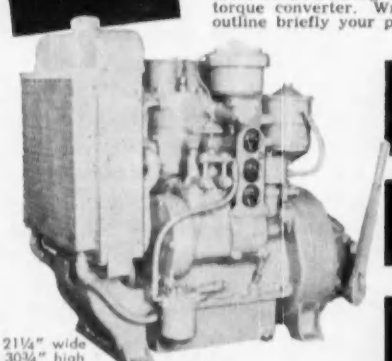
Upped to Assistant Manager
of the compressor sales department at De Laval Steam Turbine Co., is John D. Horth. He has been with the company since 1947.

John D. Horth

Sheppard DIESEL
is interchangeable with popular size gasoline engines

20 H.P.
2000 R.P.M.
Model 17

Wherever the operating economy and stamina of Diesel power is required . . . the Model 17 replaces popular size gasoline engines with practically no machine alterations or design changes. Available with complete drive including transmission or torque converter. Write today . . . outline briefly your power needs.



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21¼" wide
30¾" high
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— from intake and exhaust of air, steam and other gases discharged from engines, blowers, compressors, vacuum pumps, steam or gas turbines. Burgess-Manning Snubbers are engineered to your requirements for *quiet operation and greater efficiency*. Available with added features for spark arresting—air cleaning—water separating — heat recovery — or surge control.

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Drop pipe-line maintenance and service costs sharply — improve flow control and operating efficiency of your equipment by eliminating vibration caused by line surges from compressors, pumps and blowers. In new layouts eliminate cost of special and extra heavy supports to secure piping from vibration.

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MODEL L PUMPS ARE PERFORMANCE-PROVED

Throughout the diesel industry, Tuthill Model L pumps are recognized for their dependability in fuel transfer and hydraulic governor service. Model L is a mechanically-sealed, positive displacement internal-gear rotary pump, assuring quiet, leak-free operation with low power consumption. Capacities from .33 to 6 g.p.m. in wide pressure ranges. Available as single or double-pump units. Write for Catalog No. 101 including Pump Guide for diesel applications.

TUTHILL PUMP COMPANY

Dependable Rotary Pumps since 1927

939 East 95th Street, Chicago 19, Ill.

Canadian Affiliate: Ingersoll Machine & Tool Company, Ltd., Ingersoll, Ontario, Canada

organizational news

Now Manager of Advertising

and sales promotion at the Euclid Div. of General Motors, is R. E. Keidel. He's been with Euclid for eight years, handling publication advertising and promotion activities since 1953.

Reorganization of Field Sales

at Twin Disc Clutch Co. has resulted in the elevation of R. C. McRoberts to industry manager—engine accounts. It's in line with the company's new policy of having specialized men available whenever and wherever specialized problems arise, regardless of their geographical location.

R. C. McRoberts

G. L. Erwin

O. L. Brokaw

Sales Dept. Changes

at Cedar Rapids Engineering Co. have resulted in the advancement of George L. Erwin as general sales manager to succeed O. L. Brokaw, now sales promotion manager. Duane R. Platner will be the new assistant sales manager.

New England Distributorship

for Detroit Diesel, GM, has been granted to Hubbs Engine Co., Cambridge, Mass. The company will handle industrial engines for Massachusetts, Rhode Island, and part of New Hampshire, and marine engines in the states of Massachusetts, Rhode Island, Maine, New Hampshire, and part of Connecticut.

Topping Research Activities

at Koppers Co., Inc., is Dr. Paul W. Bachman, who has been elected vice president and director of research and development. The new appointment is in line with the company's increased emphasis on development of new products and processes.

Petroleum Equipment Sales

will be the province of Harold P. Gustavson, newly appointed manager of that phase of activities at Electro-Motive Div. of GM. At the same time to expand the division's service to the drilling industry, Arthur M. Hazell, Jr. has been appointed sales representative at Houston and R. H. Beight, technical engineer at Fort Worth, Texas.

H. P. Gustavson

news of our industry

Die-Cast Aluminum Engine Block

National Lead Co. reports that it has succeeded in casting engine blocks of aluminum by means of what it believes is the world's largest die-casting machine. The experimental 6-cyl blocks weigh about 50 lb. on emergence from the machine and 43 lb when trimmed of surplus metal. Conventional gray iron blocks cast by usual foundry methods would weigh about 175 lb.

Mr. Frank J. Koegler, vice president, pointed out that the new blocks need much less machining than those of the gray iron. And since aluminum heat conductivity is greater, a less complicated cooling system would be necessary. Its smoother surface would also make it easier to cool, he said. He estimated that a 10% price advantage would also be shown.

Development of the process was a joint project of National Lead and the Kaiser Aluminum and Chemical Corp., originally undertaken to find a way to make lighter engines for airborne jeeps. National Lead now is working with automobile manufacturers to develop a V-8 engine block of aluminum which would weigh between 70 and 75 lb. It was also disclosed that the new 6-cyl block can be made at an hourly rate of 30 to 35 pieces on a single machine that can handle dies weighing up to 50 ton. About 1700 lb of aluminum is used in this hour.

GM Opens 30th Training Center

Pittsburgh has been officially dedicated as the latest of 30 training centers operated by General Motors for continuous instruction of mechanics employed by the corporation's truck and car dealerships. It is estimated that the 30 will train or retrain 150,000 men annually. The average center has more than 27,000 sq ft and seven classrooms for one of each GM division in the automotive field.

Eligible as enrollees are mechanics from the company dealerships, from independent shops who enter through the United Motor Service Div. of GM for specialized training, and those employed by owners of GM vehicle fleets. The 29 other centers are located in or near Detroit; Cleveland; Boston; Union, N. J.; Chicago; Washington; Jacksonville; El Paso; Portland, Ore.; Dallas; Memphis; Atlanta; Philadelphia; Charlotte; Denver; San Francisco; St. Louis; New Orleans; Houston; Buffalo; Minneapolis; Oklahoma City; Tarrytown, N. Y.; Kansas City; Milwaukee; Salt Lake City; Cincinnati; and Omaha.

Rumanian Mine Locomotives

Diesel and electric mine locomotives are now being built in Rumania, according to an official release of that country. The diesel locomotives are for pulling trucks on 600- or 650-mm gauge tracks and can also be used for surface service. Their tractive effort is 3085 lb at 2.72 mph and powering is by a 4-cyl, 4-cycle engine, rated 37 bhp at 1400 rpm. Drive is through a 3-speed gearbox with internal plate clutches for ratio engagement. A single-cylinder donkey engine is used as a starter. Complete weight of the unit is 11,900 lb.

The World's Leading Manufacturers of
FUEL INJECTION EQUIPMENT
for
Diesel
Engines

DEPOTS AND SERVICE AGENTS IN OVER 100 COUNTRIES

C.A.V.

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Sales Office: 14820 DETROIT AVENUE, CLEVELAND 7, OHIO.

AP174-715.

news of our industry

Earthmoving School

Near Charlotte, N. C., 90 men are graduated every four weeks from the National School of Heavy Equipment Operation. The school, opened in April 1955, is independently owned, and offers three courses, each running a month.

The first teaches operation and maintenance of crawlers and self-propelled and tractor-drawn scrapers. Operation of the motor grader is offered by the next, and the third is concerned with crane and shovels. Much of the equipment the men work with has been leased to the school by manufacturers.

Each class is limited to 30 men, and every applicant is required to pass two mechanical aptitude tests before being admitted. Each school day begins at 6:30 am, and each group of five men has an instructor. Courses average about 70 hours of lectures plus 148 hours on the field.

Average cost of tuition is about $300. Many of the students have never driven a tractor before. Popularity of the school is evidenced by the great number of inquiries it has received. And many contractors are beginning to enroll men from their payrolls.

A contributing factor to the school's success is the critical shortage of skilled operators in heavy construction. The only known source approximating its coverage is an apprentice training program offered by the International Union of Operating Engineers (AFL-CIO), which is running into difficulties because the trainees get little chance to practice. Most equipment manufacturers can offer only short courses with limited enrollment.

Industrial Building At High

Backlogs of industrial construction are approaching the highest levels since the early part of the Korean war, T. C. Williams, president of the National Constructors Assn., reports. He explained that the impact of the industrial expansion program contracted for in 1955 would not be felt until early 1956, due to time lag between design and actuality. Technological advances in field construction methods, he stated, are helping narrow the gap of rising costs.

New Industrial X-Ray Method

A more satisfactory way of X-raying products was described to the American Institute of Electrical Engineers by General Electric Co. engineers. It utilizes an improved photoconductive X-ray pick-up tube in television inspection. In one field test, they reported, the image of the object inspected was increased to five times normal size.

Among the advantages of the new non-destructive testing tool, they listed instant viewing, high sensitivity, remote viewing in broad daylight, permanent records available on tape or by photography, unlimited number of viewing stations, magnification of image without loss of detail, and operation of the tube at 250 v. The full extent of its use is still under consideration.

ROCKFORD

NEW MORLIFE* CLUTCHES

*TRADEMARK

and

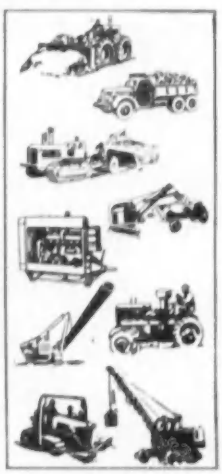
CLUTCH PLATES

Give—

100% MORE TORQUE GRIP
Reducing clutch size and engaging pressure

400% LONGER WORK LIFE
Operate longer without adjustment or plate replacement

50% BETTER HEAT DISPOSAL
Avoid down-time caused by burned or warped plates

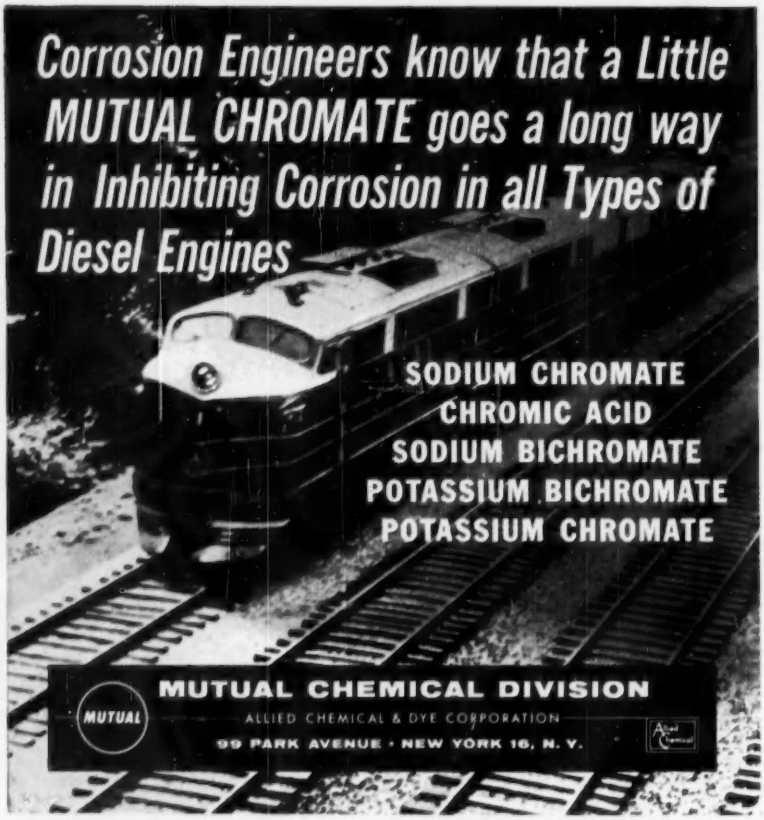


These NEW type ROCKFORD clutches have been developed and field tested by Rockford Engineers for heavy-duty clutch service. Because of their specialized characteristics, MORLIFE type ROCKFORD clutches are best suited for use in off-the-road machines such as tractors, trucks, tanks, cranes, shovels, bulldozers, earth movers, pipe layers, power units and other heavy duty equipment. For information how this NEW development will improve the operation and increase the on-the-job hours of your heavy-duty machines, write Department E.

B-W ENGINEERING BUILT IT RIGHT — B-W PRODUCTION MAKES IT AVAILABLE

ROCKFORD Clutch Division BORG-WARNER
1301 Eighteenth Avenue, Rockford, Illinois, U.S.A.

CLUTCHES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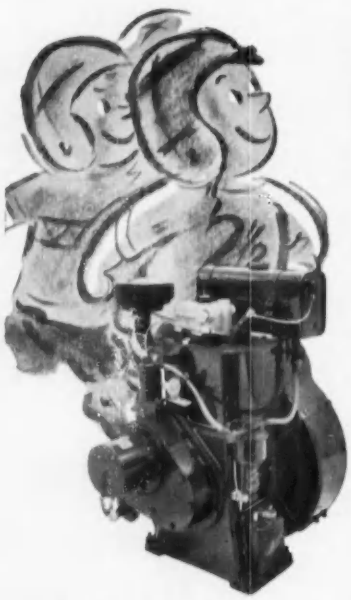

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2½ to 48 hp diesels for every industrial and marine need

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- Irrigation Pumps
- Construction Equipment
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Petter

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news of our industry

Coarse-Thread Fastener Use

Contrary to common belief, fasteners with fine threads are not as strong as those with coarse threads, Russell, Burdsall & Ward, fastener experts, declare. Fine threads may not have the rigidity and sufficient flank engagement to carry the loads. In coarse threads, the deeper and more rugged thread will carry the load and have more uniform stress concentrations, thus be better able to prevent stripping.

Another stated misconception is that fine threads stay tighter than coarse threads. Fineness or coarseness has nothing to do with tightness, it is explained. The only force that keeps a joint tight is the amount of residual tension set up by torquing. And in a fastener with coarse threads, a larger percentage of the torque effort is transferred into residual tension.

Production economies are evident in the fact that coarse thread fasteners tighten with only two-thirds the number of revolutions needed for fine threads. The coarse threads are also less likely to be damaged in handling and enter nuts or mating holes with less tendency to cross-thread when not truly positioned. Except for applications where fine adjustment must be provided, the technicians conclude, standard coarse-thread fasteners are best for both assembly and assembler.

Davenport-Besler Purchase

Canadian Locomotive Co., Ltd. has announced the acquisition of Davenport-Besler Corp. Robert H. Morse, Jr., president of the buying firm, stated the sale included locomotive designs, parts, inventories, patterns, jigs, tools, fixtures, and the trade name for Davenport's industrial locomotive line. Purchase price was not disclosed.

In addition to continuing the Iowa company operation, Canadian Locomotive will begin manufacture of the locomotive line in its home plant in Kingston, Ont. early this year for both domestic and export markets.

news of our industry

Instrument Short Course

Jan. 26 and 27 have been set as the dates of a short course, covering all phases of instrumentation, to be held at the Los Angeles Harbor Junior College. In its fifth annual session, this course is intended as a basic principles refresher for engineers as well as a means of keeping them in pace with rapidly advancing technology.

Along with technical papers presentation, there will be a practical methods section designed to train technicians in maintenance, calibration, and application of instruments and control devices. There will also be an exhibit of the latest model equipment which will provide a meeting place with manufacturers for discussion of any problems, applications, or new requirements.

Highway Expenditures Reviewed

Making the close of World War II as the base of a 10-yr period, the American Petroleum Institute has taken a look at the trend in highway spending. In the decade ending 1955, they find that expenditures for all highway purposes has more than tripled.

In payments for construction alone, they find that capital outlays for state and local road improvements are six times greater. State highway construction and reconstruction costs this year will represent a seven-time gain over the amount spent 10 years ago. In this same period, state highway user taxes have more than doubled.

All in all, however, the effect of sharply expanding construction has been a substantial drop in costs. The average cost of federal-aid highway construction for the nation as a whole is now back to the 1948 level, even slightly below. Two principal factors are said to account for this: increased mechanization of roadbuilding activities and competition among contractors. The composite of bids received on federal-aid highway projects during the first and second quarters of 1955 average 10.5 and 8.6, respectively, below engineering estimates.

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Houdaille-Hershey Name Change

Stockholders of Houdaille-Hershey Corp. have approved a change in name as being more descriptive of the corporation's widened scope of operations. It will now be known as Houdaille Industries, Inc. Executive headquarters have recently been shifted to Buffalo where four of the corporation's 12 businesses are located.

Silver Fleet Orders Diesels

As part of its scheduled modernization and replacement program, Silver Fleet Motor Express, Inc. has started its second quarter century of shipper service with the purchase of 28 turbocharged diesel tractors. E. J. Buhner, chairman of the trucking fleet, in making the announcement, stated, "Because of their ability to maintain higher average road speeds, we expect these units to improve our service."

White Motor Co. 9000 TD tractors with 175-hp Model JT-6-B Cummins Turbodiesels were specified by Silver Fleet, which, according to Mr. Buhner, were made following a thorough analysis of the latest types of transport equipment and an exhaustive survey of the company's operational needs. The firm currently operates 150 over-the-road tractors on 5854 mi of certified routes. The new tractors are expected to operate 125,000 mi a year.

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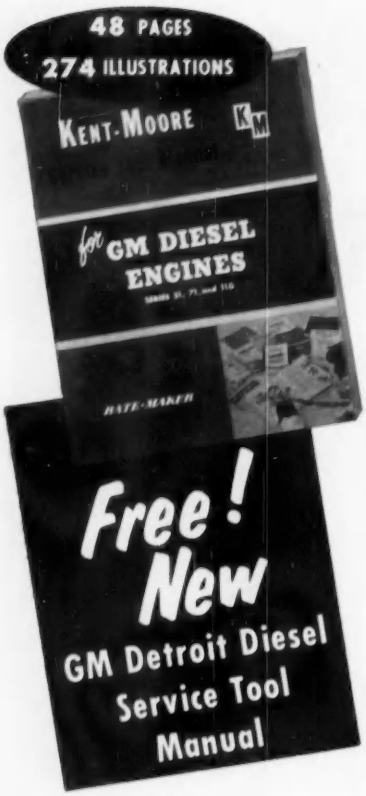

JUST RELEASED!

New 48-page GM Detroit Diesel Service Tool Manual. Contains complete information on all Kent-Moore Special Tools needed to perform factory-recommended service on GM Series 51, 71, and 110 engines used by:

- **GMC Truck and Coach Division**
- **Euclid Division**
- **Allis-Chalmers**
- **LeTourneau-Westinghouse**
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Technical Observation Plan

To help small and medium-sized companies keep up with European technological developments, Armour Research Foundation is instituting a specialized service. Under the aid program, a European office will be opened whose function will be to funnel ideas and techniques of potential value in American markets to a group of participating companies who will initially be made up of 16 non-competing firms.

Four engineers will be established in the European office, each assigned to four sponsoring companies most closely representing his field. An electrical engineer, for example, might represent firms which produce electric motors, communications equipment, electrical instruments, and electrical components. Each company will thus obtain almost personal attention in its field and effective coverage in related fields.

Sponsors of the program will be asked to sign up for a 2-yr contract, with renewal on a yearly basis. Other groups of four will be added as the program progresses, and additional observers for each new group. As the plan is outlined, each observer would attend pertinent seminars, technical meetings, trade shows, review publications and patents, and arrange for invitations to visit plants and laboratories.

Ordnance Information Request

The Army Ordnance Corps has begun preparation of a comprehensive ordnance engineering design handbook intended to summarize fundamental principles and basic design data. Ordnance engineering takes in vehicles, engines, accessories, etc., cutting across many fields of technology.

It is a matter of considerable importance that uncertainties as to meaning of terminology and nomenclature do not slow down design and development. A call has been issued for collections of terminologies, glossaries, specialized dictionaries, or even references to them to help in the project. Western Reserve University is cooperating with the Army office in preparing the handbook which is estimated to require about five years for completion. All who think they may be of help are invited to contact Allen Kent, Assoc. Dir., Center for Documentation and Communication Research, School of Library Science, Western Reserve University, Cleveland 6, Ohio.

San Francisco Receives Macks

Delivery of the first 10 of 440 new Mack diesel-powered buses has been accepted by the city and county of San Francisco as part of its giant modernization program. The bus order, totaling over $9 million, is believed to be one of the largest single awards for bus equipment made by any city since World War II.

Mack will deliver 100 of the new buses by the end of the year and the remainder over the next five years. The buses, of a new lightweight design, have 48-passenger seating capacity and are 102-in wide. Main comfort features for the passenger are greater headroom, pressure ventilation, and air springs. They're equipped with Mack's Thermodyne turbocharged diesels to give maximum power in negotiating San Francisco's steep grades.

Diesel Power in Ranching

A prominent role in the operation of a modern 1600-acre ranch near Ontario, Cal., is played by eight diesel-powered units. At the cattle ranch of Pat Vernola, the diesels are used to handle both cultivation and irrigation of his sandy-soil farm, where he also raises beans, alfalfa, grapes, and grain. He feeds over 400 head of cattle.

The sandy soil necessitates a sprinkling system for irrigation. One engine powers a deep well pump, lifting water about 65 ft to irrigate the vineyards. Another drives a centrifugal booster pump for 42 sprinkler heads irrigating the alfalfa. A third powers a pump for the bean fields.

Five track-type tractors are employed in cultivating and harvesting the crops. All the diesels are from the Caterpillar Tractor Co.

news of our industry

Double-Duty Farm Tractor

At the farm of Verne Robinson in Coral, Mich., an Oliver Super 99 tractor powered by a Detroit Diesel 3-71 engine has stepped up plowing from 10 acres per day to 30 acres. At the time Mr. Robinson bought the tractor, he was also looking for an engine to operate an irrigation pump.

The extra purchase proved unnecessary when he discovered that the same tractor diesel with a rear power takeoff could double around the clock as a pumping engine. For planting, the tractor pulls a 5-bottom plow and clod buster to prepare the soil in one operation. During the growing season, the tractor is hooked up to a pump to put water through the farm's irrigation system at 800 gpm.

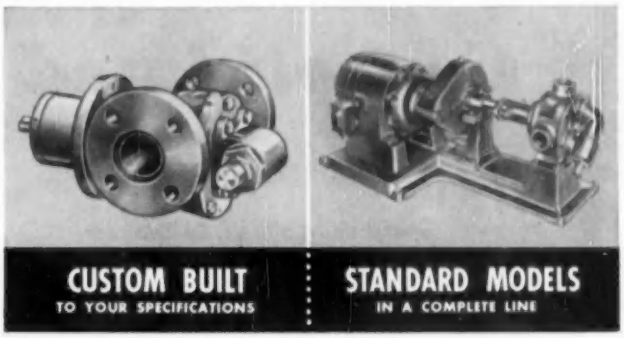
Form Piggyback Car Supply

Pennsylvania Railroad and Rail-Trailer Co. have combined forces to form Trailer Train Co., which will operate a flat car pool for piggybacking highway trailers on rails. The new company is presently developing a new type of car which is expected to provide substantial economies in initial cost, maintenance, and operation.

Carbide Customer Courses

Special sessions on the milling cutter applications of carbide and on the application of carbide as wear-retarding components have been added to customer training courses to be offered the first half of 1956 by General Electric Co.'s Carboloy Dept. Regular training on cutting tools will continue to be given as well, but will now also include throw-away-type carbide inserts and use of a new machinability computer.

The new milling session will include carbide grade selection, brazing, grinding, milling speeds, table travel, and machine horsepower. Those on the wear-retarders will cover methods of attachment, design consideration, and grinding procedures.



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Consolidated Index For 1955

An index is for finding things. So this year DIESEL POWER presents it's Consolidated Index for 1955 in new, easy-to-locate form for your convenience.

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Incandescent sparks from the exhaust of engines are claimed to be safely trapped by the Gill spark arrestor, produced by Erickson Products Co. It is attached on the end of the exhaust pipe and is essentially a circular tube with a tangent entrance for the exhaust pipe and a tangent tube to which a removable collector cup is attached. Inside the circular tube a central slot permits escape of exhaust gases.

Operating by centrifugal force, it carries hot carbon particles to the cup collector for periodic disposal of the carbon. The collection of sparks involves no moving parts, no maintenance, the manufacturer states, and negligible back pressure on the engine.

New Teflon Hose Line

Aeroquip Corp. is introducing Line 666 hose, which features Teflon inner tube and specially designed detachable reusable fittings. Announced characteristics include ability to withstand extreme temperatures, imperviousness to acids and other fluids not transportable by synthetic or rubber hose, light weight, and small size.

The fittings can be attached and detached by hand without use of special tools. Pointing out that the material of the hose appears to be ageless, the company states it is also practically inert chemically.

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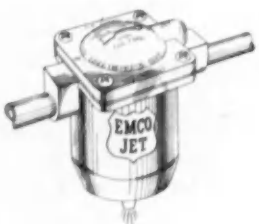
Air Tool Filter

Emco Pneumatic Corp. has come out with a 12-oz air filter whose major parts are made of aluminum, and which is automatic and self-adjusting. Sludge, abrasives, rust, scale, and moisture are prevented from entrance to pneumatic tools, it is stated.

Called the Model L-200A, it operates by pressure differential. As air flows through the unit, substances with a greater-than-air specific gravity collect in the main chamber of the unit. Sudden stop of air flow causes an internal valve to change position, and in this instant, the collected water and foreign matter are jetted through the opening at the bottom of the separator. This process repeats each time the air is released and stopped. The unit has a range of 1 cfm to 20 cfm, and operates from 60- to 250-lb air pressure.



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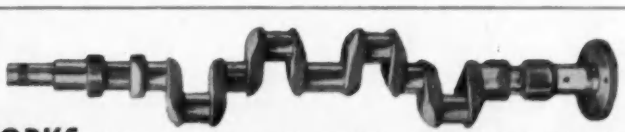

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new products

Portable Steel Cutter

Precision cutting of heavy gauge sheet metals, both ferrous and non-ferrous, is the claim for a 13-lb portable nibbler introduced by Fenway Machine Co. Designated Model HN, it is rated to handle stainless steel up to 10 gauge; milder steels and non-ferrous metals to 8 gauge.

The nibbler will follow templates and cut from any angle. It will also handle contoured or corrugated stock. Minimum cutting radius is 6 in. Cutting action comes from a high-speed tool-steel punch and die which takes a ¼-in slug with each stroke. Speed at full load is 600 strokes per min. Motor is the universal-type, about 1 hp, with a 3-wire, 9-ft rubber cord. A ground-safe fuse cap and fuse are available as optional equipment.

Teflon Packing

Flexrock Co., has developed a plastic packing which may be used as emergency packing and for centrifugal applications. Called Flexrock 403, it is composed of shredded Teflon combined with binders and lubricants extruded into an open cotton yarn jacked impregnated with graphite. It is claimed chemically inert and will not be attacked by acids, alkalies or solvents.

The product is serviceable from -150F° to 550°F and can be used on all applications (dynamic or static) that require the chemical resistance of Teflon. The packing is installed by cutting it in necessary lengths, coiling it around shaft, and placing it into the stuffing box by any suitable means. It is self-forming and is available from ¼- to ¾-in sizes in 1/16-in increments.

Vibration Isolators

For medium and heavy weight machinery, a line of vibration mountings has been developed by T. R. Finn & Co., Inc. Called Finnflex floating pillow mountings, they feature a pair of "double deflection" rubber isolators which are mounted at an angle between a semi-steel base and cover.

The rubber's inherent damping is said to restrain excessive motion of the equipment. In addition, compression loading of the isolators is said to minimize the effect of shock and overload. The degree of shock protection is controlled by a preloading nut on the mounting.

Pressure Indicator

For laboratory testing, a pressure pickup featuring a quartz crystal transducer and a composite diaphragm has been introduced to this country from Switzerland. Kistler Instrument Co., which supplies the unit, states that it is suitable for most engine applications including cylinder pressure measurements on supercharged and air-cooled diesel engines. It measures pressures up to 3000 psi, and with a special adapter, above 20,000 psi.

The complete SLM pressure indicator consists of a pressure gauge and a combination amplifier and calibration unit, the Piezo-Calibrator. This latter is used to match the high impedance of the gauge to the input impedance of a DC oscilloscope and to provide means for accurate pressure calibration.

Tough Metal Cutter

A new high-speed steel blade introduced by Porter-Cable Machine Co. for its portable band saw is said to be capable of cutting through such hard materials as stainless steel, carbon tool steel, nickel, and high-speed tool steel.

The Porta-Band, which the special blade fits along with conventional blades, is operated by a ½-hp motor. Band speed is 240 surface fpm under load and enables cutting of rectangular stock up to 3¼-in by 4¼-in, or round stock up to 3¼-in diam.

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new products

Gear Reduction Pulley

Hart Reduction Pulley Co. is manufacturing a V-belt pulley equipped with built-in gear reductions ranging from 7:1 to 700:1 standard and up to 8000:1 custom. It is claimed to eliminate special gear reduction units, and provide reductions often requiring two or more reducing units.

Two reductions are claimed: first from the motor pulley to the reduction pulley through the V-belt drive; and then through internal planetary gearing in the pulley interior. The unit consists of a housing with V-belt grooves, a cover, a held gear, an output gear, and two or four pinions, together with necessary bearings. It runs in oil and can also be adapted to gear or chain drive.

Oil Filter Element

Over 500 directional louvers for maximum flow and filtration are contained in an oil filter packed with pulverized cellulose, produced by Stay-Ready Laboratories, a division of Salyer Refining Co. The processed cellulose is said to filter out water, lead salts, and sludge-forming acids and abrasives, with no effect on oil additives.

Another claim for the filter is that it holds water away from additives, to eliminate valve rattles on cold starts and insure complete lubrication. Literature is available.

Portable Storehouse

On-the-spot supply distribution is provided by a mobile storage unit manufactured by Material Master, Inc. in 42- and 128-in lengths. Each unit is constructed of heavy-gauge corrugated sheet steel mounted on wooden flooring. This gives rigidity with minimum weight and permits the structure to be moved.

A specially designed trailer is available to do the transporting, with a capacity of one large storehouse or three small ones. Future production plans envisage 63- and 84-in long units.

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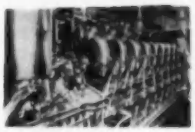

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organizational news

Eastern District Sales Manager

is the title of W. S. James, newly appointed by Houdaille-Hershey of Indiana, Inc. His territory comprises all of New England, New York, New Jersey, Pennsylvania, Delaware, Maryland, and part of Virginia.

Executive Vice President

a new position, has been extended to B. Bynum Turner, vice president in charge of research and engineering at Ethyl Corp.

Home Office Manager

of the gas and oil industry sales engineering section at Cooper-Bessemer Corp., is the new assignment of David M. Salls. In his newly created post, he'll be responsible for coordinating factory engineering and field service.

H. M. Short

F. Townsend

In Marketing Posts

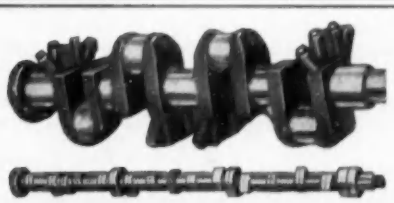
at Alco Products, Inc., are Herbert M. Short, appointed product manager of renewal parts, and Frederick Townsend, replacing Paul N. Strobell as locomotive product manager. Mr. Strobell has been assigned as marketing manager for atomic energy products.

New at C. Lee Cook

is William H. Barnes, just appointed vice president and general sales manager. He was with Clark Bros. Co. for 10 years and previous to that with Standard Oil.

David M. Salls

William H. Barnes



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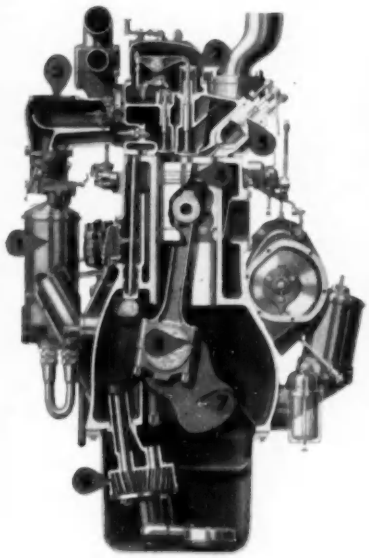
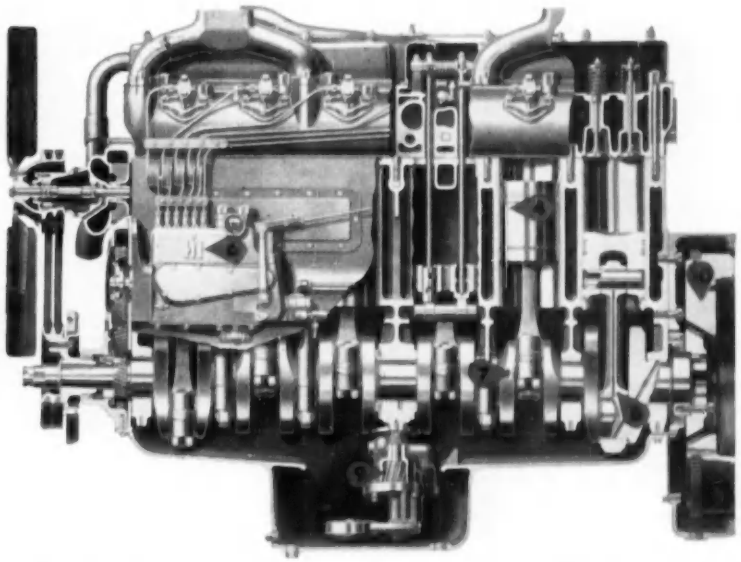
5 SIMPLE, SINGLE-HOLE, INJECTION NOZZLE and pre-combustion chamber set at 45° angle for smooth, clean combustion of low grade No. 2 fuel oil under all engine speed and load conditions.





6 NEW IH INJECTION PUMP: Single plunger type on four-cylinder models, twin-plungers on six-cylinders . . . provide all cylinders equal amounts of fuel, precisely metered to load, whether for idling, maximum horsepower, or maximum torque under overload. New, harder injection plungers have up to four times longer life.

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